United States Department of Energy

Savannah River Site

Record of Decision
Remedial Alternative Selection for the SRL Seepage Basins Operable Unit (904-53G1, -53G2, -54G and –55G) (U)

WSRC-RP-97-848

Revision 1.1

October 1999

Prepared by:
Westinghouse Savannah River Company LLC
Savannah River Site
Aiken, SC 29808

Prep-cd for U.S. Department of Energy under Contract No. DE-AC09-96SR18500

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by
Westinghouse Savannah River Company LLC
Aiken, South Carolina

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Westinghouse Savannah River Company LLC
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Savannah River Operations Office
Aiken, South Carolina

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DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

Savannah River Laboratory (SRL) Seepage Basins Operable Unit (OU) (904-53G1, -53G2, -54G and -55G)

Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Identification Number: OU-47

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Identification Number: SC1890008989

Savannah River Site (SRS)
Aiken, South Carolina

SRL Seepage Basins (SRLSB) OU is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Unit/CERCLA unit in Appendix C of the Federal Facility Agreement (FFA) for SRS.

Statement of Basis and Purpose

This decision document presents the selected remedial action for the SRLSB OU located at SRS, south of Aiken, South Carolina, which was chosen in accordance with CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this site.

The state of South Carolina agrees with the selected remedy.

Assessment of the Site

The response action selected in this Record of Decision (ROD) is necessary to protect the public health, welfare, or the environment from actual or threatened releases of hazardous substances into the environment.

Description of the Selected Remedy

Within the overall site strategy, the SRLSB OU is located within the Upper Three Runs Watershed. OUs within this watershed will be evaluated to determine impacts, if any, to the associated streams and wetlands. SRS will manage all OUs to prevent impact to the Upper Three Runs Watershed. Upon disposition of all OUs within this watershed, a final comprehensive ROD for the watershed will be pursued.

The preferred alternative for remediating the SRLSB OU is Alternative S-5B. The alternative includes the excavation and off-SRS disposal of all soil above 1 x 10^{-3} industrial risk (principal threat source material) and entails the following actions;

- Excavation of 1 foot of soil from the bottom and berms of Basin 1
- Excavation of 4 feet of soil from the bottom and 1 foot from the berms of Basin 2
- Excavation of 1 foot from the bottom and berms of Basin 3
- No soil will be removed from Basin 4
- Removal of the process sewer pipeline and associated soils from Basin 1 to the first manhole
- Backfill of all four basins and the trench with clean soil. This soil cover will then be vegetated to prevent erosion. The depth of the clean soil will nominally be between 9 to 16 feet
- Transportation and disposal of all excavated soil and the pipeline to an approved, licensed, out-of-state low-level waste disposal facility such as Envirocare of Utah, Inc.
- Institutional controls would remain in place and preclude residential development and disturbance of the cover. A unit-specific Land Use Control Implementation Plan (LUCIP) would be developed for this alternative.

This alternative will meet the remedial action objectives of protecting human health and the environment by eliminating surficial soil exposure, and removing all principal threat source material. Residual contamination (at levels below 1 x 10^{-3} risk) will remain in place. However, the basins will be backfilled with clean soil and an earthen cover placed over the four basins. These actions combined with both short term and long term institutional controls will eliminate any risk to the industrial worker. The estimated present worth cost associated with Alternative S-5B is $3,550,000.

The deepest aquifers beneath the SRLSB unit (Lost Lake and Crouch Branch) are contaminated with tetrachloroethylene and trichloroethylene above drinking water Maximum Contaminant Levels. However, these constituents are not found in significant concentration in the vadose zone soils or the shallowest aquifer (M-Area) below the SRLSB. Since these facts suggest that the SRLSB is not the source of this contamination, this remedial action will not address groundwater contamination. Groundwater remediation of volatile organic compounds in the area of the SRLSB OU as a result of other release points in the A/M area is being managed under the RCRA Part B Permit for the M-Area Hazardous Waste Management Facility.

The post-ROD document Corrective Measures Implementation/Remedial Action Implementation Plan, has been submitted to the U.S. Environmental Protection Agency (US EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC).

SCDHEC has modified the SRS RCRA permit to incorporate the selected remedy.

Statutory Determinations

Based on the SRLSB RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report and the Baseline Risk Assessment (BRA) (WSRC1998a), the SRLSB OU poses significant risk to human health and the environment.

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to

the remedial action, and is cost effective. However, because treatment of the principal threat source material was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element.

This preferred alternative is intended to be the final action for the SRLSB OU. The solution is intended to be permanent and effective in both the long and short terms.

Because this remedy will result in residual hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Per the US EPA-Region IV Land Use Controls (LUC) Policy, a LUC Assurance Plan (LUCAP) for SRS has been developed and submitted to the regulators for their approval. In addition, a LUC Implementation Plan (LUCIP) for the SRLSB OU has been developed and submitted to the regulators for their approval with the post-ROD documentation. The LUCIP details how SRS will implement, maintain, and monitor the land use control elements of the SRLSB OU preferred alternative to ensure that the remedies remain protective of human health and the environment.

The LUC objective is to prevent unauthorized access and exposure to residual soil contamination at the unit. The institutional controls required to prevent unauthorized exposure to residual contamination include the following:

- Controlled access to SRLSB OU through existing SRS perimeter fences and the site use/site clearance programs
- Signs posted in the area to indicate that contaminated soil is present in the OU
- Deed notification to any future land owner of the presence and location of contaminated soil, as required under CERCLA Section 120(h)

In the long term, if the property is ever transferred to nonfederal ownership, the U.S. Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of radioactive and chemical wastewater. These requirements are also consistent with the intent of the RCRA deed notification requirements at final closure of a RCRA facility if contamination will remain at the unit.

The deed shall also include deed restrictions precluding residential use of the property. However, the need for these deed restrictions may be re-evaluated at the time of transfer in the event that exposure assumptions differ and/or the residual contamination no longer poses an unacceptable risk under residential use. Any re-evaluation of the need for deed restrictions will be done through an amended ROD with US EPA and SCDHEC review and approval.

In addition, if the site is ever transferred to nonfederal ownership, a survey plat of the operable unit will be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

Data Certification Checklist

This ROD provides the following information:

- Contaminants of concern (COCs) and their respective concentrations
- Baseline risk represented by the COCs
- Cleanup levels established for the COCs and the basis for the levels
- Current and future land and groundwater use assumptions used in the Baseline Risk Assessment and ROD

- Land and groundwater use that will be available at the site as a result of the Selected Remedy
- Estimated capital, operation and maintenance (O&M), and total present worth cost; discount rate; and the number of years over which the remedy cost estimates are projected
- Decision factor(s) that led to selecting the remedy (i.e., describe how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria).

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10/27/99
Date

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Assistant Manager for Environmental Programs
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15 DEC 99
Date

Richard D. Green
Division Director
Waste Management Division
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03/15/00
Date

R. Lewis Shaw
Deputy Commissioner
Environmental Quality Control
South Carolina Department of Health and Environmental Control

DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

SRL Seepage Basins OU (904-53G1, -53G2, -54G and –55G) (U)

WSRC-RP-97-848
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Aiken, South Carolina

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LIST OF ACRONYMS AND ABBREVIATIONS

ARARs	Applicable or relevant and appropriate requirements
BRA	Baseline Risk Assessment
CAB	Citizens Advisory Board
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
Ci	Curies
CMCOC	Contaminant migration constituent of concern
CMS	Corrective Measures Study
COC	Constituent of concern
COPC	Constituent of potential concern
CRSB	C-Reactor Seepage Basin
CSF	cancer slope factor
CSM	Conceptual site model
dpm	Disintegrations per minute
DOT	Department of Transportation
FCMS/FS	Focused Corrective Measures Study/Feasibility Study
FFA	Federal Facility Agreement
HI	Hazard index
HQ	Hazard quotient
LLC	Limited Liability Company
LLWDF	Low-Level Waste Disposal Facility
LS	Lump Sum
LUC	Land Use Control
LUCAP	Land Use Control Assurance Plan
LUCIP	Land Use Control Implementation Plan
mg/kg	Milligram per kilogram
mL	Milliliter
NCP	National Oil and Hazardous Substances Contingency Plan
NEPA	National Environmental Policy Act
OU	Operable unit
pCi/g	PicoCuries per gram
PP	Proposed Plan
RBC	Risk-based concentration
RAO	Remedial action objective
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RG	Remedial goal
RGO	Remedial goal options
RI	Remedial investigation
RL	Remedial level

RME	reasonable maximum exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SB	Statement of Basis
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulations
SREL	Savannah River Ecology Laboratory
SRL	Savannah River Laboratory
SRLSB	SRL Seepage Basins (OU)
SRS	Savannah River Site
SRTC	Savannah River Technology Center
SVOC	semi-volatile organic compound
TAL	target analyte list
TMR	total media risk
US DOE	United States Department of Energy
US EPA	United States Environmental Protection Agency
USC	unit-specific constituents
VOC	volatile organic compounds
WSRC	Westinghouse Savannah River Company

I. SAVANNAH RIVER SITE AND OPERABLE UNIT NAME, LOCATION AND DESCRIPTION

Savannah River Site Location and Description

Savannah River Site (SRS) occupies approximately 3 10 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina (Figure 1). SRS is located approximately 25 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina.

The United States Department of Energy (US DOE) owns SRS, which historically produced tritium, plutonium, and other special nuclear materials for national defense and the space program. Chemical and radioactive wastes are by-products. of nuclear material production processes. Hazardous substances, as defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), are currently present in the environment at SRS.

Operable Unit Name, Location and Description

Savannah River Laboratory (SRL) Seepage Basins Operable Unit (OU) (904-53G1, -53G2, -54G and -55G)

Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Identification Number: OU-47

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Identification Number: SC 1890008989

Savannah River Site (SRS)
Aiken, South Carolina
United States Department of Energy

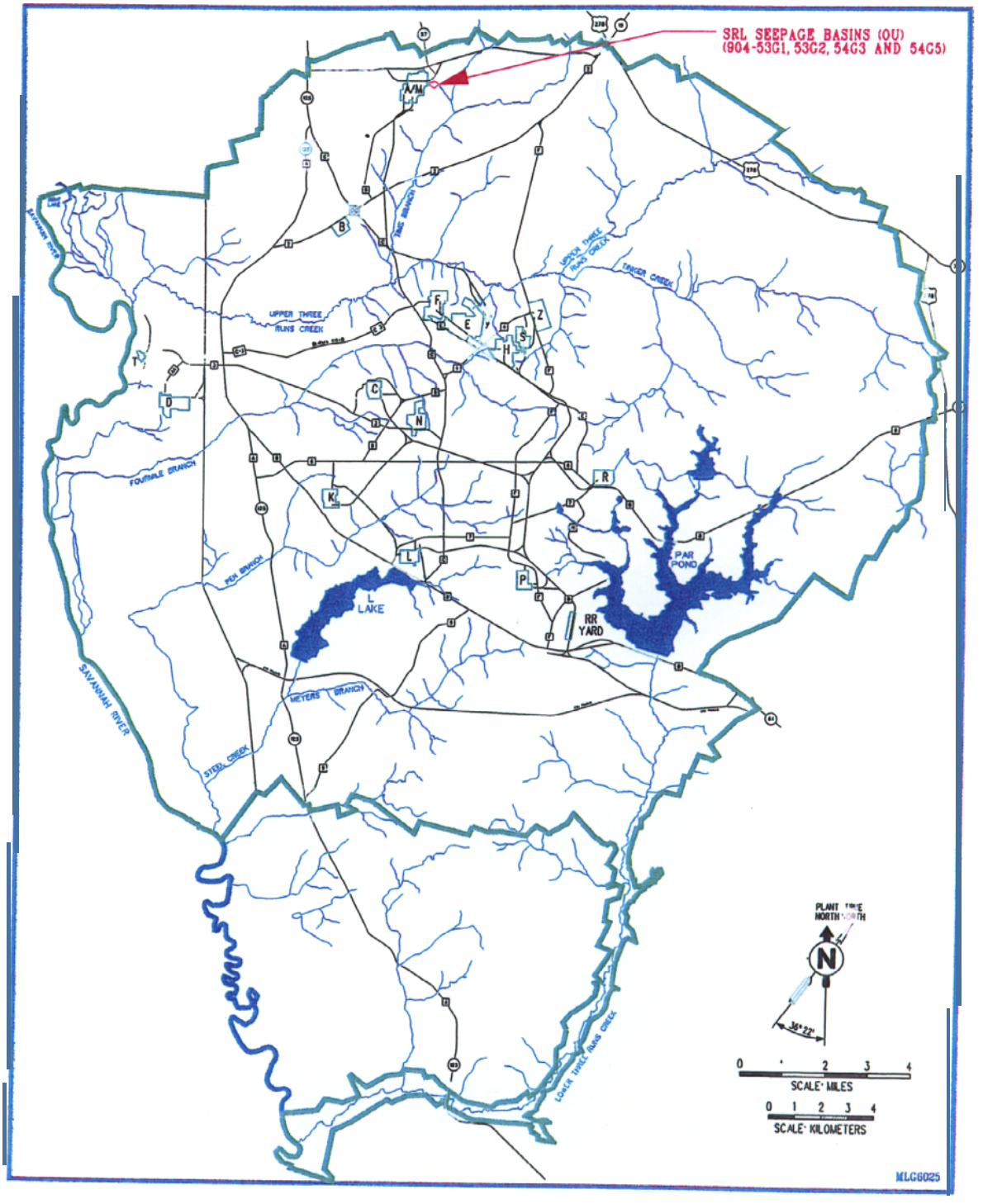


Figure 1.1 Location of the Savannah River Site and Major SRS Facilities

A map showing the SRL Seepage Basins (SRLSB) OU in relation to the major SRS facilities is included in Figure 1. The SRLSB OU is located in the northwestern section of SRS, about 4,000 feet from the nearest SRS boundary and 4,500 feet from the nearest residence. A more detailed map of the immediate vicinity is shown in Figure 2. This map shows that the SRLSB lies (in relation to True North) within the northern portions of the A/M Area, northeast of the Savannah River Ecology Laboratory (SREL) and southeast of the Savannah River Technology Center (SRTC). Road 1-A is located immediately west of the SRLSB, and Tims Branch is located northeast of the unit. The setting to the north, east, and south of the unit is wooded. The northern edge of the unit is bounded by Tims Branch, which is approximately 50 feet away. The topography falls steeply at a 20-percent grade from the northern edge of Basin 4. An unnamed intermittent tributary to Tims Branch is approximately 154 feet from the southern edge of Basin 1. The topography falls at a 10.5-percent grade to the tributary branch.

The eastern edge of the basins is also bounded by the same unnamed tributary. Basins 1, 2, and 3 are approximately 220 feet away while the eastern edge of Basin 4 is 112 feet away. Topography from the eastern edges of Basins 1, 2 and 3 falls steeply at a 23-percent grade to the streambed. Topography from the eastern edge of Basin 4 falls at an 1 l-percent grade to the unnamed tributary bed. The area to the west is cleared and vegetated with low grasses. See Figure 3 for an aerial photograph of the SRLSB OU.

The SRLSB OU consists of four unlined basins that received low-level radioactive wastewater from SRL until 1982. Basins 1 and 2 were placed into operation in 1954, and Basins 3 and 4 were added in 1958 and 1960, respectively. Basins 1, 2, and 3 were constructed by excavating below the original ground

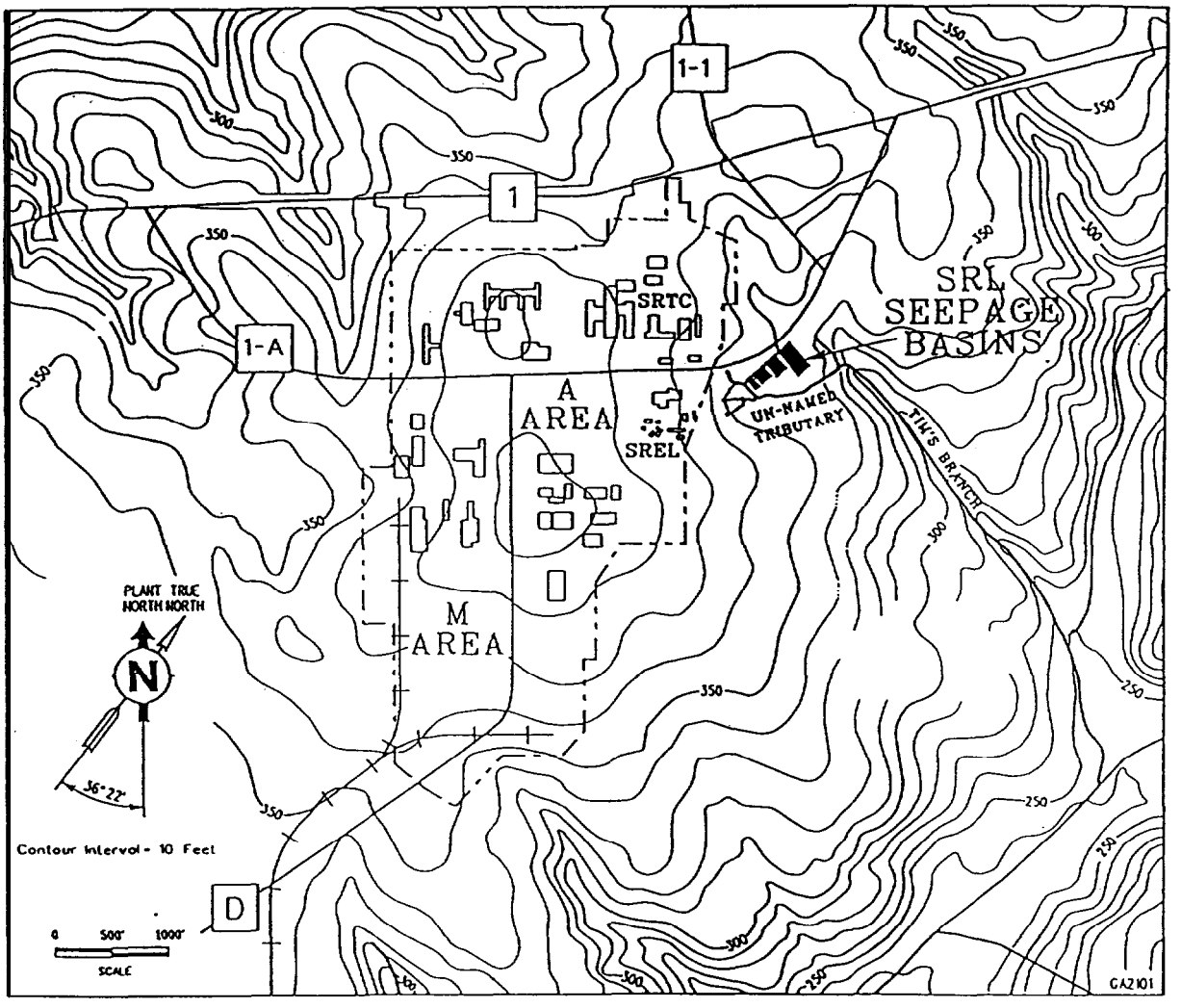


Figure 2. SRLSB Location in A/M Area

Figure 3. Aerial Photograph of SRLSB Unit (For Directional Orientation, the Basins are on the Southeast Side of the SRS Road 1-A Shown in the Photograph)

surface. The basin floors and the berm walls below the original ground surface are undisturbed native soils. Because the original topography **north** of Basin 3 sloped toward Tims Branch, the materials removed during Basin 4 construction were used as fill to construct part of its basin floor, portions of its western and eastern perimeter, and all of the northern perimeter berm.

II. SITE AND OPERABLE UNIT COMPLIANCE HISTORY

SRS Operational and Compliance History

The primary mission of SRS has been to produce tritium, plutonium-239, and other special nuclear materials for our nation's defense programs. Production of nuclear materials for the defense program was discontinued in 1988. SRS has provided nuclear materials for the space program as well as for medical, industrial, and research efforts up to present. Chemical and radioactive wastes are byproducts of nuclear material production processes. These wastes have been treated, stored, and in some cases, disposed at SRS. Past disposal practices have resulted in soil and groundwater contamination.

Hazardous waste materials handled at SRS are managed under the Resource Conservation and Recovery Act (RCRA), a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities have required South Carolina Department of Health and Environmental Control (SCDHEC) operating or post-closure permits under RCRA. SRS received a hazardous waste permit from SCDHEC, which was most recently renewed September 5,1995. Module IV mandates corrective action requirements for non-regulated solid waste management units subject to RCRA 3004(u).

On December 21,1989, SRS was included on the National Priorities List, This inclusion created a need to integrate the established RFI Program with the

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA, 42 USC Section 9620, US DOE negotiated a Federal Facility Agreement (FFA) (FFA 1993) with the United States Environmental Protection Agency (US EPA) and SCDHEC to coordinate remedial activities at SRS as one comprehensive strategy which fulfills these dual regulatory requirements. US DOE functions as the lead agency for remedial activities at SRS, with concurrence by US EPA – Region IV and SCDHEC.

Operable Unit Operation and Compliance History

The SRLSB OU was used from 1954 to 1982 to dispose of low-level radioactive liquid waste generated in the laboratories located in Buildings 735-A and 773-A. The laboratory-derived, low-level liquid waste was stored in Building 776-A waste tanks until the activity was confirmed to be below 100 dpm/mL alpha and/or 50 dpm/mL beta-gamma. Waste meeting this transfer criterion was then sent via the process sewer line to Basin 1. Waste that did not meet this criterion was transferred to the H-Area Tank Farm by tanker truck. The average activity for waste discharged to the basins was 50 dpm/mL for both alpha and beta-gamma.

Waste was transferred from the laboratories to the basins via a 900-foot long, 10 inch diameter, clay process sewer line pipe that discharged into the western end of Basin 1. The four basins are connected by a series of sequential overflow channels. The SRLSB total approximately 2.15 acres and have the following dimensions:

Basin No.	Length (feet)	Width (feet)	Depth (feet)
1	129	62	11
2	129	129	11
3	176	125	11
4	300	150	14

During the 28 years of operation, the basins received a total of 4,550,000 cubic feet (ft^3) (34,034,000 gallons) of wastewater, or an average of 162,000 ft^3 (1,212,000 gallons) per year.

The transfer records from 1958-1980 were reviewed, and a summary of these historical discharges of radionuclides to the SRLSB is presented in the following table:

Parameter	Activity (Ci)
Tritium	105
Strontium 89, 90	0.4
Cesium 137	4.7
Natural Uranium	0.022
Plutonium 238	0.009
Plutonium 239	0.003
Americium 241	0.001
Curium 242, 244	0.001
Ruthenium 103, 106	1.4
Cobalt 60	0.1
Cerium 141, 144	2.7
Alpha (unidentified)	4.2
Beta-gamma (unidentified)	10.6

Based on the historical data, the following are the primary chemical constituents discharged to the SRLSB OU over its 28-year life: nitrate, sodium, chlorine, calcium, phosphorus, chromium, and silicon. Process knowledge suggests that no significant quantities of chlorinated organics were discarded to the low-level tanks of Building 776-A or the SRLSB.

In late 1971, two nonroutine releases were made to the SRLSB during decontamination of the SRL high-level radioactive facilities. In the first release, contaminated wash water leaked into the SRL Auxiliary Pipe Trench beneath Building 773-A and then seeped into a storm sewer that discharges to Tims

Branch. When the leak was discovered, Tims Branch was temporarily dammed below Road 1-A just upstream of the confluence of the unnamed tributary. The contaminated water was pumped to SRL Seepage Basin 4. In the second release, highly contaminated water entered the 904-A Process Trench and was inadvertently transferred to the low-level waste system instead of the high-level waste system. It was subsequently discharged to SRL Seepage Basin 1. The primary isotope identified for both transfers was curium-244. Cobalt-60 and cerium-144 were also detected. It was estimated that about 0.315 Ci and 0.680 Ci of curium-244 were released to Tims Branch/Basin 4 and Basin 1, respectively.

The basins were taken out of service in 1982. Subsequently, various grasses, bushes and weeds became established in the basins, on the intrabasin berms, and on the northern perimeter of Basin 4. Over the years large trees grew in and around the basins. This vegetation was extensively sampled and analyzed and found to be radioactive. The dispersion of plant debris by the wind contributed to the spread of contamination. Ecological receptors in and around the basins were able to access the contamination through the ingestion of the contaminated plant matter (mainly leaves and berries). Other species, which in turn feed on these species, had the potential to accumulate even greater contaminant loadings. Therefore, the vegetation was cut and chipped in the summer of 1997 as a CERCLA removal action.

The chipped vegetation is temporarily stored inside the basins and a geosynthetic cover has been placed over and around the vegetation. These two actions have reduced any potential for the vegetation to spread outside of the OU until final disposal at the SRS Low Level Waste Disposal Facility (LLWDF). The disposal of this contaminated vegetation is not a component of the preferred remedial alternative for this operable unit and will be performed as a separate action under US DOE's removal action authority. Completion of this removal action will be

conducted in advance of, or in coordination with, the final CERCLA remedial action described in this ROD.

The SRLSB OU was identified as a solid waste management unit requiring investigation in the Natural Resources Defense Council Consent Agreement settled under Civil Action Number 1:85-25883-6. This decree required SRS to submit various documents, including a closure plan for the units. A closure plan proposing the installation of a RCRA cap was written and submitted in 1993 using procedural requirements applicable to RCRA closure plans (WSRC1993a). Revision 0 of the closure plan received a Notice of Deficiencies/Warning from SCDHEC and was revised and reissued. Revision 1 received considerable comment from public stakeholders. After consideration of comments, SCDHEC determined that a more comprehensive evaluation of the unit and closure alternatives was warranted. US DOE and SCDHEC decided that the SRLSB OU should be evaluated under the RCRA/CERCLA process, which considers remedial alternatives against the nine CERCLA criteria to select a remedy protective of human health and the environment. The remedy presented in this ROD is the outcome of the integrated RCRA/CERCLA remedial action described in this ROD.

The Rev. 0 RFI/RI Work Plan was submitted to US EPA and SCDHEC on December 18, 1995. The RFI/RI characterization field-start date was September 25, 1996. The RFI/RI sections of the SRLSB OU report conform to requirements specified in RFI/RI guidance documents. The Baseline Risk Assessment (BRA) was conducted using data generated from the RFI/RI unit assessment and evaluates potential risks posed by the unit to both human health and the environment. The Focused Corrective Measures Study/Feasibility Study (FCMS/FS) section of the report is based on data and evaluations presented in the RFI/RI and BRA portions of the report. The Statement of Basis/Proposed Plan

(SB/PP) for the SRLSB OU (WSRC1998b) presented the suite of alternatives for cleanup, and the preferred alternative, to the community. Section XV of this document contains the post-ROD document schedule, including the remedial action start date.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Both RCRA and CERCLA require the public be given an opportunity to review and comment on the draft permit modification and proposed remedial alternative. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternatives for addressing the SRLSB OU soils and groundwater. The Administrative Record File must be established at or near the facility at issue. The SRS Public Involvement Plan (DOE, 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS Public Involvement Plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act, 1969 (NEPA). SCHWMR R. 6 1-79.124 and Section 117(a) of CERCLA, as amended, require the advertisement of the draft permit modification and notice of any proposed remedial action and provide the public an opportunity to participate in the selection of the remedial action. The SRL Seepage Basin OU ROD, a part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the SRLSB OU.

The FFA Administrative Record File, which contains the information pertaining to the selection of the response action, is available at the US EPA office and at the following locations:

U.S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

The RCRA Administrative Record File for SCDHEC is available for review by the public at the following locations:

The South Carolina Department of Health and Environmental Control
Bureau of Land and Waste Management
8901 Farrow Road
Columbia, South Carolina 29203
(803) 896-4000

Lower Savannah District Environmental Quality Control Office
218 Beaufort Street, Northeast
Aiken, South Carolina 29802
(803) 641-7670

The public was notified of the public comment period for the SB/PP through the *SRS Environmental Bulletin,* a newsletter sent to approximately 3,500 citizens in South Carolina and Georgia, and through notices in the *Aiken Standard, Allendale Citizen Leader, Augusta Chronicle, Barnwell People Sentinel,* and *The State* newspapers. The public comment period was also announced on local radio stations.

The 45-day public comment period began on January 29,1999 and ended on March 14,1999. A Responsiveness Summary was prepared to address any comments received during the public comment period. The Responsiveness Summary is provided in Appendix B of the ROD. It will also be available in the final RCRA permit

At SRS, additional opportunity for public involvement is provided through the activities of the SRS Citizens Advisory Board (CAB). At the recommendation of the CAB, a focus group was assembled to discuss the remediation of the basins. The focus group, consisting of a cross-section of citizens from both Georgia and South Carolina, CAB members, SCDHEC, US EPA, and US DOE, met several times and provided input to the remedial alternatives to be evaluated. The focus group and the CAB had two requests that have been considered throughout the remedial process. They requested that the selected remedial alternative be cost effective and the remedial action be accelerated because of the potential risk associated with the close proximity of the SRLSB to the site boundary. Recommendations provided by the CAB were considered by US DOE and the regulatory agencies during remedy selection.

IV. SCOPE AND ROLE OF THE OPERABLE UNIT WITHIN THE SITE STRATEGY

RCRA/CERCLA Program at SRS

RCRA/CERCLA units (including the SRLSB OU) at SRS are subject to a multi-stage remedial investigation process that integrates the requirements of RCRA and CERCLA as outlined in the FFA (FFA 1993). The RCRA/CERCLA processes are summarized below:

- investigation and characterization of potentially impacted environmental media (such as soil, groundwater, and surface water) comprising the waste site and surrounding areas

- the evaluation of risk to human health and the local ecological community
- the screening of possible remedial actions to identify the selected technology which will protect human health and the environment
- implementation of the selected alternative
- documentation that the remediation has been performed competently
- evaluation of the effectiveness of the technology

The steps of this process are iterative in nature, and include decision points which require concurrence between US DOE as owner/manager, US EPA and SCDHEC as regulatory oversight agencies, and the public (see Figure 4).

Operable Unit Remedial Strategy

The SRLSB OU has been grouped into a source control OU located within the Upper Three Runs Watershed at SRS. Several source control and groundwater OUs within this watershed will be evaluated to determine future impacts, if any, to associated streams and wetlands. It is the intent of US DOE, US EPA, and SCDHEC to manage these sources of contamination to minimize impact to the watershed. To effectively manage the impact to the Upper Three Runs Watershed (groundwater, streams, and wetlands), a comprehensive characterization and regulatory process plan for the waste units in the vicinity of the SRLSB OU was developed. This characterization and regulatory process plan provides a programmatic method of promoting continuous characterization, risk assessment, remedial assessment, and remedial action.

Characterization of the SRLSB OU revealed that the highest concentrations of contaminants and the contaminants with the highest potential risk were primarily restricted to surface soils and subsurface soils within the SRLSB. In addition, it

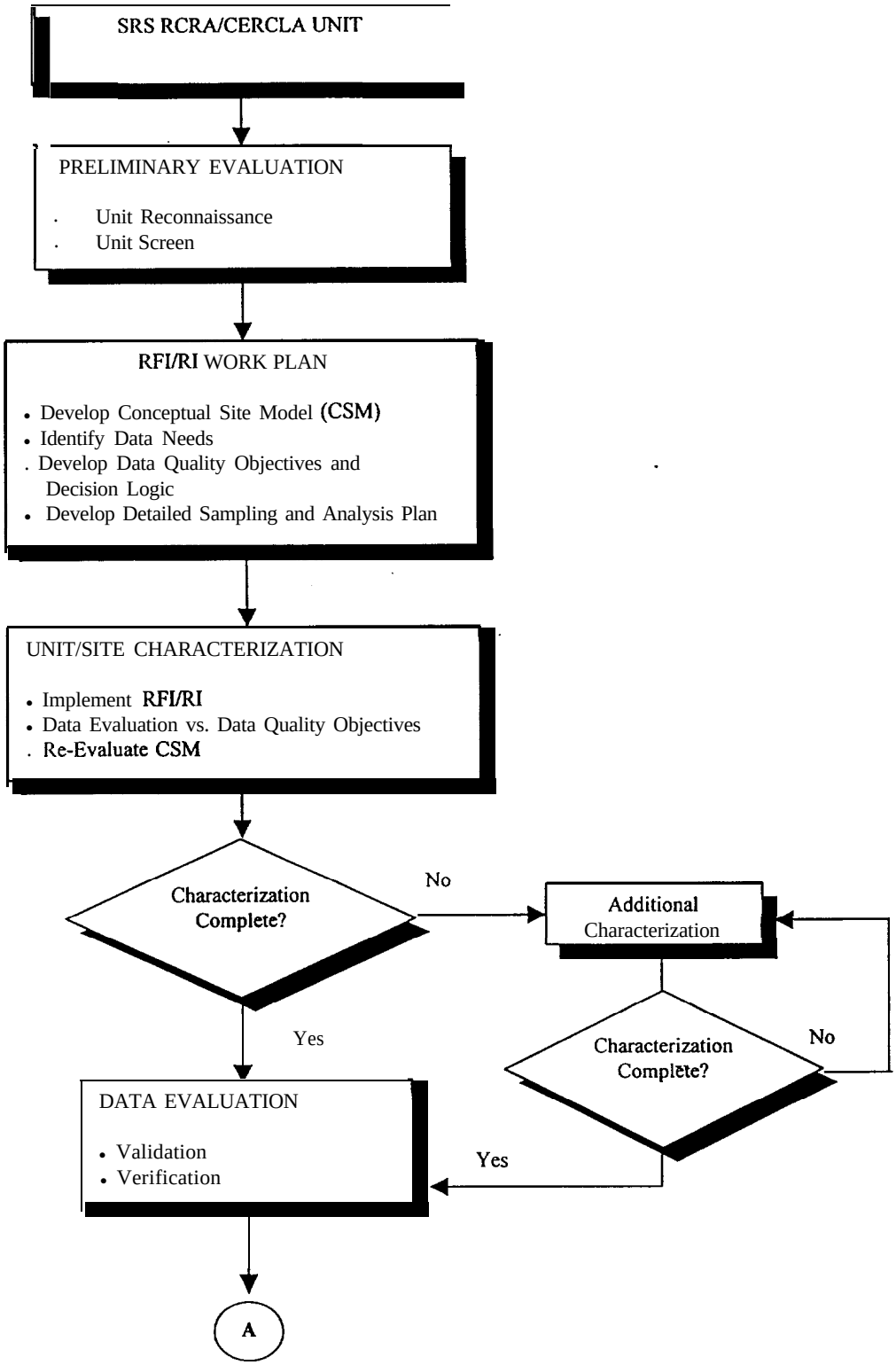


Figure 4. RCRA/CERCLA Logic and Documentation

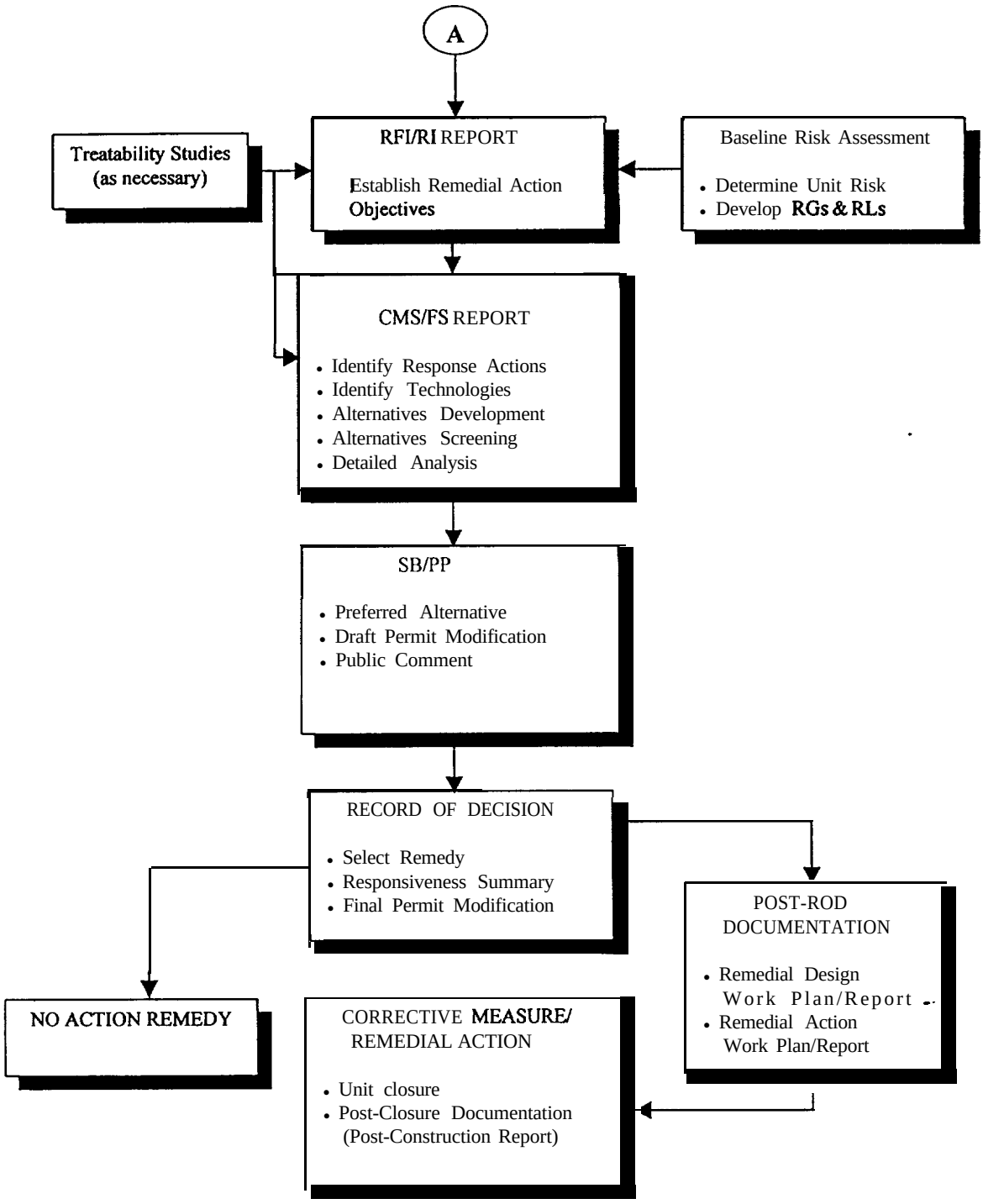


Figure 4. RCRA/CERCLA Logic and Documentation (cont'd)

was determined that the SRLSB OU does not represent a source of contamination to unit groundwater. Characterization of the SRLSB OU and its associated RFI/RI and BRA documentation provide sufficient information to move forward with a remedial action. Therefore, the FCMS/FS, the SB/PP and this ROD are focused on this source control OU.

The conceptual site model (CSM) identified groundwater as an exposure pathway. Groundwater sample results from four quarterly sampling events were used to evaluate potential exposures and risks.

The distribution of volatile organic compounds (VOCs) in the M-Area Aquifer zone is concentrated side- and downgradient of the SRLSB OU and is associated with a VOC plume originating from the SRTC complex. Infiltration of groundwater through the confining layer has resulted in migration of VOCs from the M-Area Aquifer zone into the Lost Lake Aquifer zone. Horizontal groundwater flow in the Lost Lake Aquifer zone has resulted in downgradient migration of VOCs to the south. The plume has migrated through the water table (M-Area Aquifer zone) and into the Lost Lake Aquifer zone, with the plume boundary currently downgradient of the SRLSB. Remediation of the VOC plume through pump and treat technology is ongoing. Currently, six recovery wells (screened in the Lost Lake Aquifer zone) are extracting VOC-contaminated groundwater in the northern part of the A/M Area. Groundwater beneath the SRLSB is within the zone of capture of this remediation system. The effectiveness of this remedial effort is monitored under the M-Area RCRA Part B Permit for the M-Area Hazardous Waste Management Facility.

V. OPERABLE UNIT CHARACTERISTICS

Conceptual Site Model for the Operable Unit

A CSM was developed for the SRLSB OU to identify the primary sources, primary contaminated media, migration pathways, exposure pathways, and potential receptors for each of the four basins (Figures 5 through 8). The CSM for the SRLSB OU is based on the data presented in the RCRA/CERCLA documentation for these units (WSRC 1998a), which contains detailed analytical data for all of the environmental media samples taken in the characterization of the SRLSB OU. This document is available in the administrative record file (see Section III).

As stated in Section IV, characterization of the basins revealed that the highest potential risk to human health and the environment is primarily restricted to soil within the SRLSB OU. There are no contaminant migration constituents of concern (COCs) for the SRLSB OU that would drive additional soil remediation activities to protect groundwater from future contaminant leaching.

Media Assessment

An RFI/RI Work Plan to acquire the site characterization data was developed for the SRLSB OU (WSRC 1996). The RFI/RI established unit-specific constituents (USCs) to determine their distribution in source media associated with the unit. These characterization data provide the contaminant profile and mass information necessary to determine the potential for contaminant migration to off-unit receptors. For a more complete discussion of the characterization, see the RFI/RI/BRA (WSRC 1998a).

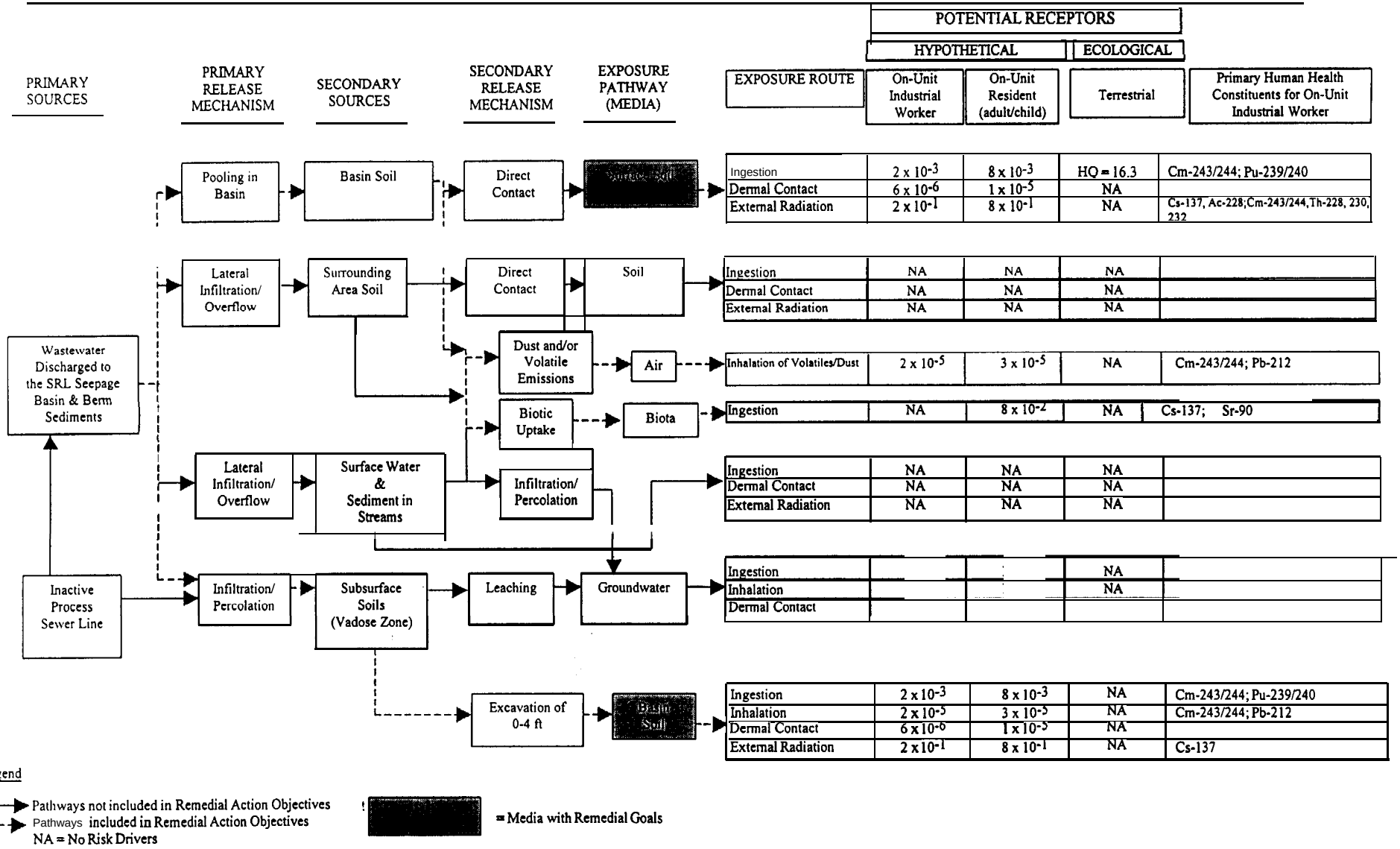


Figure 5. Revised Conceptual Site Model for SRL Seepage Basin 1

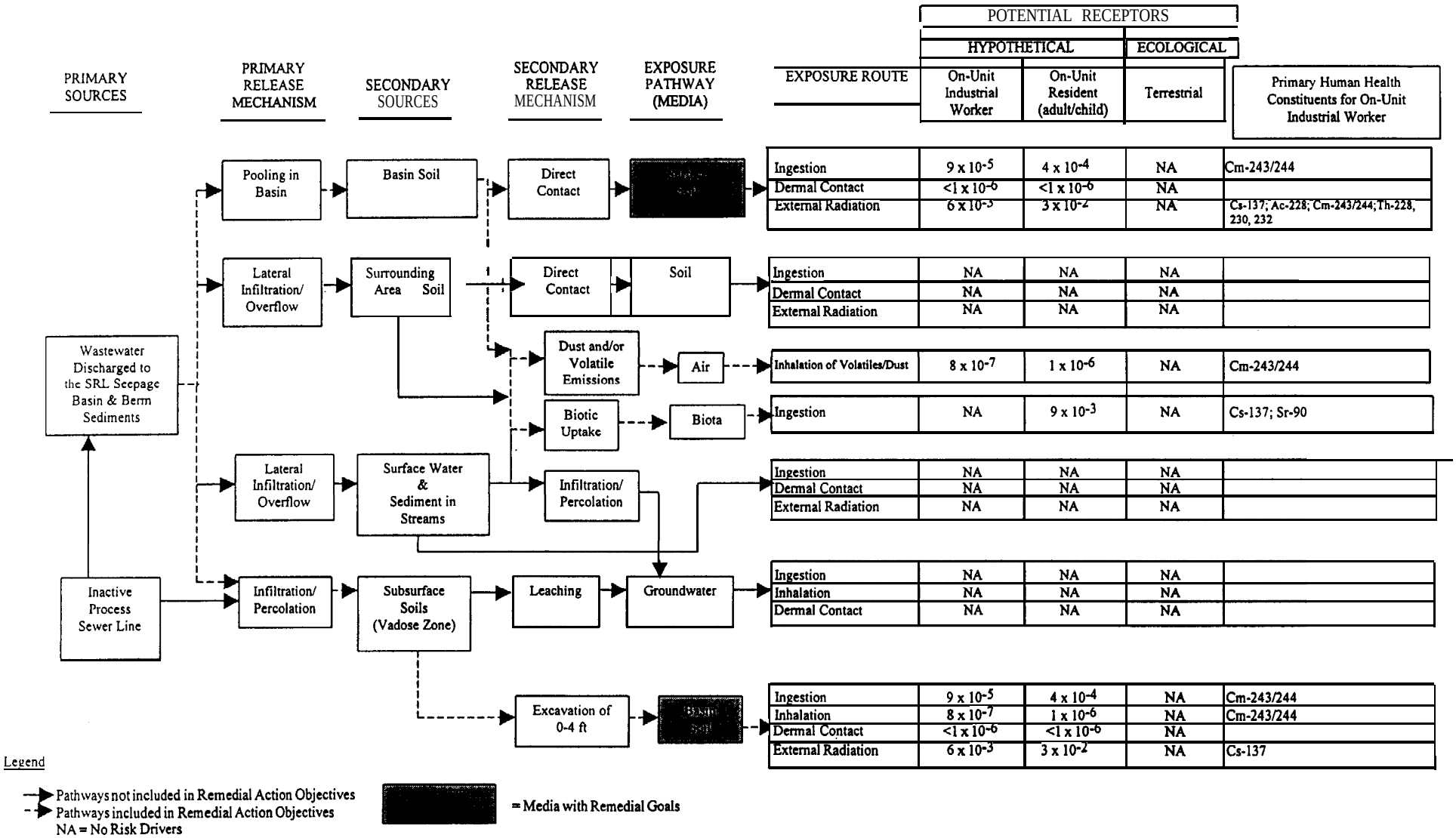


Figure 6. Revised Conceptual Site Model for SRL Seepage Basin 2

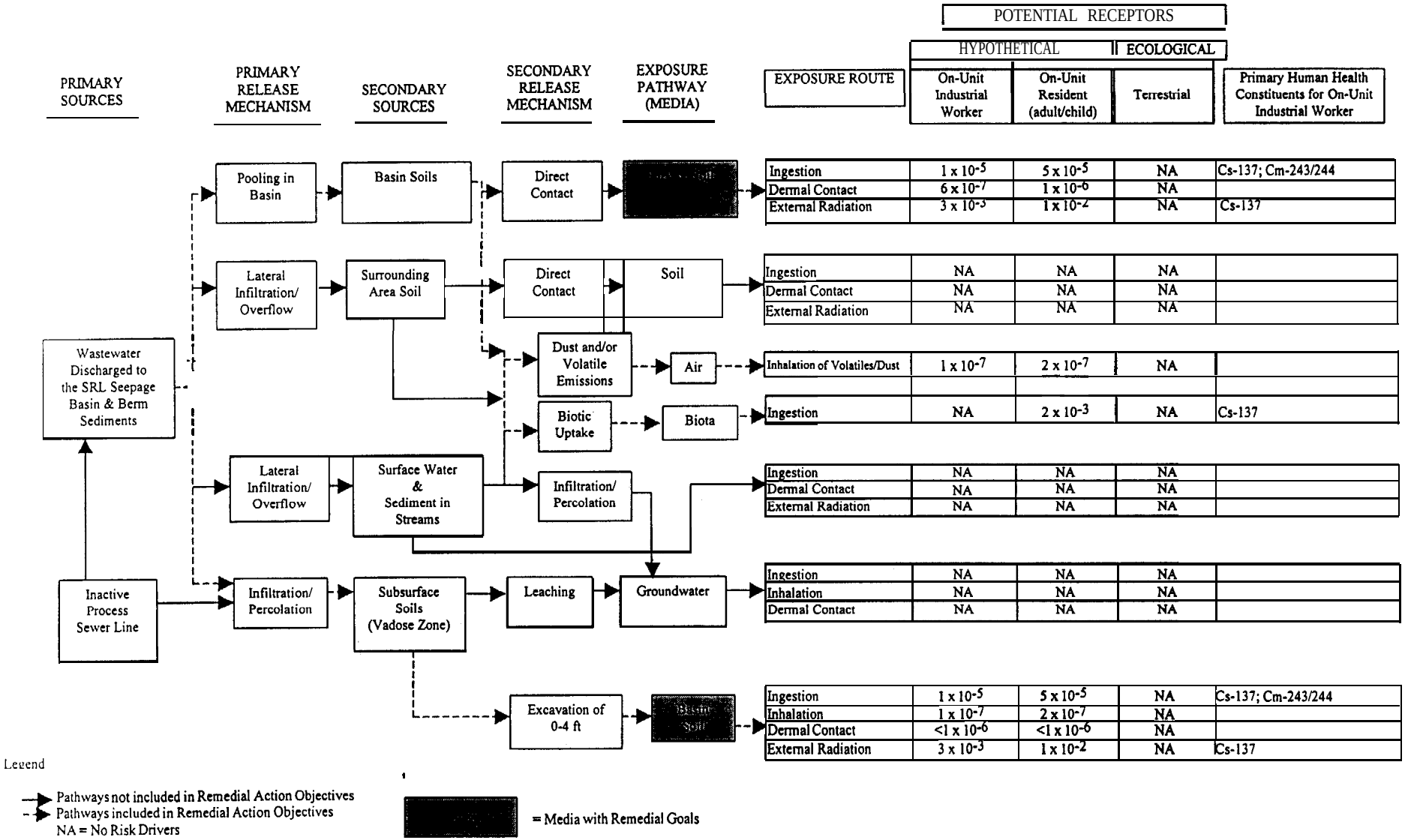


Figure 7. Revised Conceptual Site Model for SRL Seepage Basin 3

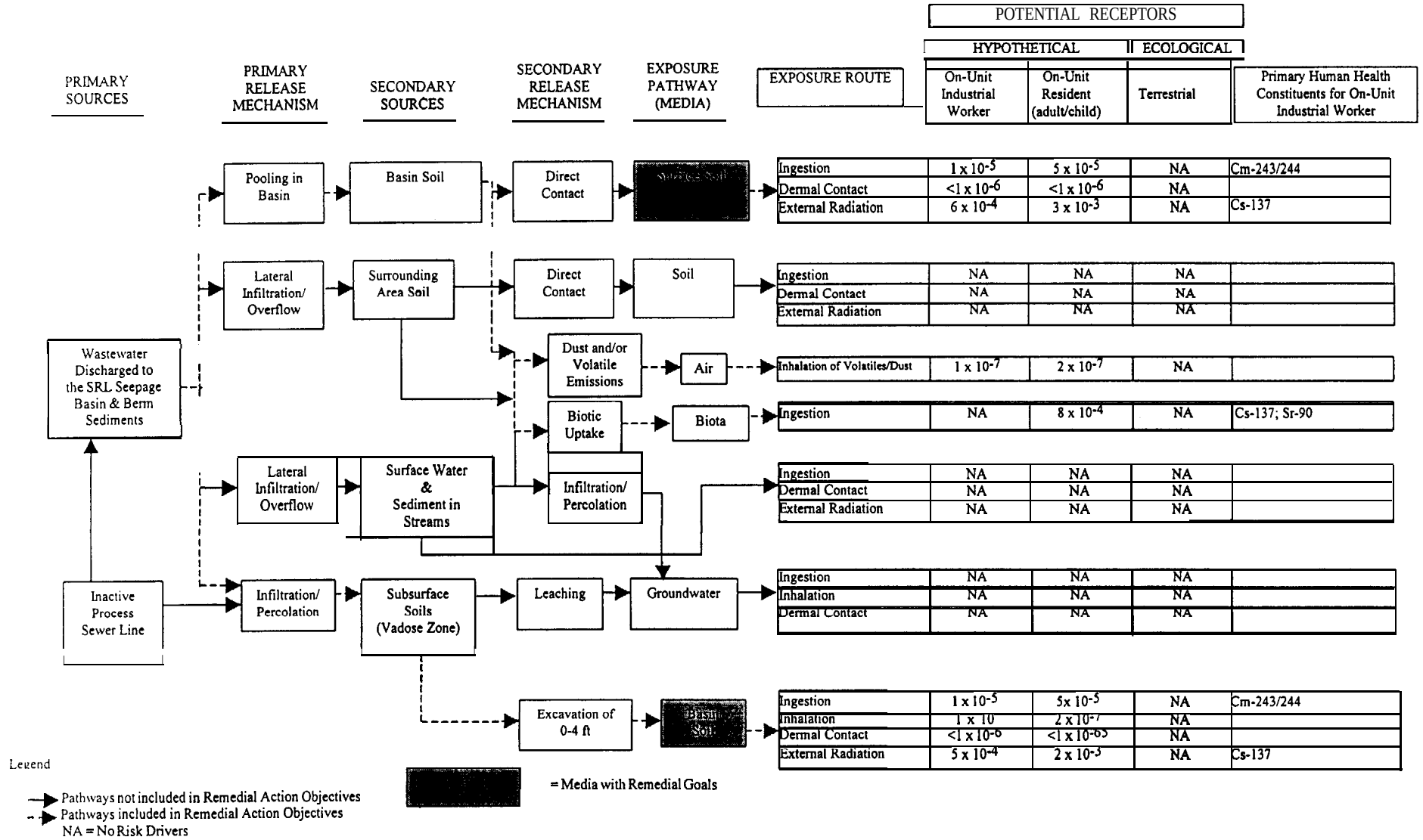


Figure 8. Revised Conceptual Site Model for SRL Seepage Basin 4

The primary source of contaminants was wastewater discharged in the past to the basins and basin sediments and to the inactive process sewer line (see Figures 5 through 8). In addition to routine wastewater discharged to the basins, Basin 4 also received contaminated water diverted from Tims Branch in 1971. The details of the diversion can be found in the RFI/RI work plan for the SRLSB OU (WSRC 1996).

Hazardous and/or radioactive wastes may have been or may be released from the primary sources of contamination by pooling of liquids in the basins; lateral flow or overflow to the berm and surrounding areas; infiltration/percolation of the wastewater into basin sediments, subsurface soils and groundwater and/or lateral infiltration/migrations to surface water, soils and sediments (see Figures 5 through 8).

The primary media impacted by discharge of wastewater to the four seepage basins are basin sediment, soil in the basin bottoms and berms, soil in the surrounding areas, subsurface soils beneath the basins and inactive process sewer line, and surface water and sediment associated with Tims Branch and the unnamed tributary of Tims Branch. Therefore, these are also secondary sources of contaminants.

The secondary sources of contamination considered in the CSM include soil in the basins and basin berms, ephemeral surface water in the basins and streams, and stream sediment that was possibly impacted by discharge of wastewater. An RFI/RI/BRA was conducted to characterize the potential sources of contamination, delineate the extent of hazardous substances released from the SRLSB, enhance geological characterization of the area, estimate the baseline risk posed by the basins, identify COCs, and propose remedial action levels.

Secondary release mechanisms associated with these sources include the following:

- direct contact with soils in basins and surrounding areas,
- airborne dust transport and volatile emissions from the soils/sediments and surface water in the basins, streams, berms, and surrounding areas,
- biotic uptake occurring in the basins, streams, berms, and surrounding areas,
- infiltration/percolation of surface waters in the basins and from the stream areas,
- leaching and transport of contaminants from the subsurface soils beneath the basins and/or beneath the inactive process sewer lines, and
- future excavation of subsurface soils.

The most significant of these secondary sources are airborne dust transport and volatile emissions from the soils/sediments and surface water in the basins, streams, berms, and surrounding areas. Whereas these secondary sources are significant, the remedy selected will preclude these from consideration as a risk. Subsequent to removal of the 1×10^{-3} risk contaminated soil from Basins 1, 2, and 3, the basins will be filled with clean soil. Once backfilling is initiated, there would not be a threat from these secondary sources; backfilling will be performed to +9 feet below grade. The quantified risks associated with these and other exposure path routes are summarized in Section VII.

The characterization of the primary and secondary sources associated with the SRLSB OU indicates that the basin soils contain anthropogenic radionuclides and metals. The concentrations of the radionuclides, metals, and volatiles in the basins decrease substantially with depth.

Contaminant Transport Analysis

Sample results indicate that the contamination at the SRLSB OU is primarily limited to the top one foot of the berms and bottoms of Basins 1 and 3, the top one foot of the berm of Basin 2, and the top four feet of the bottom of Basin 2. The contaminant concentrations within these intervals are above the 1 x 10^{-3} industrial risk, and therefore considered as principal threat source material. Basin 4 does not contain contamination that exceeds 1 x 10^{-3} risk; hence, principal threat source material is not present in this basin and will, therefore, not be removed. The population potentially at risk to exposure to this contamination through direct contact is limited to current and future on-unit industrial workers and future on-unit residents. Fate and transport analysis does not predict any future impacts to the groundwater from the contaminants within the SRLSB OU.

VI. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Land Uses

Current land use at the SRLSB OU is industrial, although there are no permanently located workers at the unit. Since the land is likely to remain under the control of the United States Government, it is not likely to ever be used for residential purposes. The future use recommendation contained *in the Savannah River Site Future Use Project Report* (US DOE 1996) is "future industrial". The potential future uses of this unit are as a research and development (pilot scale) industrial facility and possibly an industrial manufacturing facility.

Groundwater/Surface Water Uses

There is no surface water within the boundaries of the SRLSB OU. However, as shown in Figure 2, the headwaters of Tims Branch lie in the immediate vicinity of the unit. Tims Branch is not currently used as a source of drinking water or for

industrial applications. It is not likely that Tims Branch will ever be used for these applications.

There are currently no drinking water wells in the area. Institutional controls will prevent the installation of drinking water wells in the area. These controls are necessary due to groundwater contamination below the SRLSB OU from other upgradient contaminant sources in the A/M Area.

VII. SUMMARY OF OPERABLE UNIT RISKS

As part of the investigation/assessment process for the SRLSB OU, a BRA was performed using data generated during the investigation phase. An evaluation of the potential for the migration of soil contaminants to groundwater and risks to human and ecological receptors was performed during the development of chapters 5 and 6 of the RFI/RI/BRA/FCMS/FS report (WSRC 1998a). This evaluation provided the basis for remedial action. The evaluations performed in the fate and transport analysis and the BRA resulted in the identification of preliminary COCs.

Preliminary COCs included primary and secondary human health COCs, ecological COCs with hazard quotients (HQs) greater than 1 or a risk greater than 1.0×10^{-6}, and contaminant migration COCs (CMCOCs). These were selected because they exceed risk-based criteria in the BRA or because they are projected to have the potential to leach to the groundwater at levels exceeding a maximum contaminant level or risk-based concentration (RBC). The uncertainties associated with the preliminary COCs for human health, ecological, and fate and transport risks were evaluated in an uncertainty analysis in order to select a final set of COCs for remediation considerations.

The subsections below discuss the final list of COCs and their associated remedial goals (RGs) for contaminant migration, human health, and ecological scenarios,

and applicable or relevant and appropriate requirements (ARARs), respectively, for the SRLSB OU. RGs are chemical concentration goals for specific medium and land use combinations. They are designed to provide conservative, long-term targets for the selection and analysis of remedial alternatives. The following discussions focus on the basin exposure units (Basins 1 through 4) since no unacceptable risks were posed from soils inside or outside the fence line, groundwater, or surface water and sediments from Tims Branch and its associated tributary.

Contaminant Migration COCs

No final CMCOCs are present at the SRLSB OU.

Human Health Risk Assessment

Cancer risk is the chance that a person exposed to the site over a specific period of time would be likely to develop cancer. Cancer risks are measured in terms of total media risk (TMR), which is the summation of the cancer risks for all exposure routes for a given medium.

Non-cancer risk is measured in terms of a hazard index (HI) which sums the non-cancer risks for all exposure routes for a given medium. A value greater than 1 indicates that the contaminant is present at levels above those found to be safe.

The risks to the hypothetical future resident and hypothetical future industrial worker are summarized below.

Hypothetical Future On-Unit Resident

The objective of the future on-unit resident assessment is to provide a baseline of the risk associated with an on-unit resident for comparison with the future

industrial worker. Since the land is likely to remain under the control of the United States Government, it is not likely to ever be used for residential purposes.

Cancer risks for exposures to radionuclide constituents were evaluated for future exposures to surface and subsurface soil at the SRL Seepage Basins 1, 2, 3, and 4.

Seepage Basin 1

The total unit cancer risk for the future on-unit resident exposed to radionuclides at SRL Seepage Basin 1 is 9 $x10^{-1}$ for surface and subsurface soils. The uncertainty analysis determined that non-radiological COCs were Chromium and mercury.

Seepage Basin 2

The total unit cancer risk for the future on-unit resident exposed to radionuclides at SRL Seepage Basin 2 is 4 $x10^{-2}$ for surface and subsurface soils. Based on the uncertainty analysis there were no non-radiological COCs.

Seepage Basin 3

The total unit cancer risk for the future on-unit resident exposed to radionuclides at SRL Seepage Basin 3 is 1 $x10^{-2}$ for surface and subsurface soils. Based on the uncertainty analysis there were no non-radiological COCs.

Seepage Basin 4

The total unit cancer risk for the future on-unit resident exposed to radionuclides at SRL Seepage Basin 4 is 4 $x10^{-3}$ for surface and subsurface soils. Based on the uncertainty analysis there were no non-radiological COCs.

Summary

Although the most likely future land use is industrial, the above discussion indicates that a total cancer risk for the future resident exists for Basins 1, 2, 3, and 4. In addition, as a result of chromium and mercury contamination, a non-cancer risk to future resident also exists in Basin 1. This potential on-unit residential risk mandates the maintenance of short term and long term institutional controls so that the risk pathway is eliminated.

Hypothetical Future Industrial Worker

Cancer risks for exposures to radionuclide constituents were evaluated for future exposures to surface and subsurface soil at the SRL Seepage Basins 1, 2, 3, and 4. The estimates are presented in Figures 5 through 8 and the preliminary COCs for the hypothetical industrial worker are shown below.

Seepage Basin 1

The TMR estimates for radionuclides are 2×10^{-1} for surface soil and 2×10^{-1} for subsurface soil. The final list of radiological COCs is americium-241, actinium-228, cesium- 137, cobalt-60, curium-243/244, potassium-40, lead-2 12, plutonium-238, plutonium-239/240, radium-228, strontium-90, thorium-228, thorium-230, thorium-232, uranium-233/234, uranium-235, and uranium-238.

The non-cancer' COCs for exposure to the industrial worker (surface and subsurface soils) are mercury and hexavalent chromium.

Seepage Basin 2

The TMR estimates for radionuclides are 6×10^{-3} for surface soil and 6×10^{-3} for subsurface soil. The final list of COCs is americium-241, actinium-228, cesium-137, cobalt-60, curium-243/244, neptunium-239, potassium-40, plutonium-238, plutonium-239/240, radium-228, strontium-90, thorium-228,

uranium-235, and uranium-238. Based on the uncertainly analysis in the RFI/RI/BRA report, there were **no** nonradiological COCs.

Seepage Basin 3

The TMR estimates for radionuclides are 3 x 10^{-3} for surface soil and 3 x 10^{-3} for subsurface soil. The final list of COCs is cesium-137, cobalt-60, curium-243/244, neptunium-239, uranium-235, and uranium-238. Based on the uncertainly analysis in the RFI/RI/BRA report, there were no nonradiological COCs.

Seepage Basin 4

The TMR estimates for radionuclides are 6 x 10^{-4} for surface soil and 5 x 10^{-4} for subsurface soil. The final list of COCs is cesium-137, cobalt-60, curium-243/244, radium-228, strontium-90, and thorium-228. Based on the uncertainly analysis in the RFI/RI/BRA report, there were no nonradiological COCs.

Ecological Risk Assessment

The objective of the ecological risk assessment is to evaluate the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to unit-related constituents based on a weight-of-evidence approach. This assessment is conducted for soil, surface water, and sediment only since ecological receptors are not exposed to groundwater. The assessment is based on the potential effects to assessment endpoints at the unit. Five assessment endpoints have been identified for this unit.

- Protection of soil invertebrates to ensure that ingestion of soil contaminants does not have a negative impact on growth, survival, and reproduction
- Protection of small mammal communities from toxic effects of soil contaminants to maintain species diversity and to ensure that ingestion of soil contaminants does not have a negative impact on growth, survival, and reproduction

- Protection of herbivorous mammal communities from toxic effects of soil contaminants to maintain species diversity and to ensure that ingestion of contaminants in prey and soils does not have a negative impact on growth, survival, and reproduction
- Protection of insectivorous birds to ensure that ingestion of contaminants in prey and soils does not have a negative impact on growth, survival, and reproduction
- Protection of aquatic communities from toxic effects of surface water and sediment contaminants to maintain species diversity and to ensure that ingestion of surface water and sediment contaminants does not have a negative impact on growth, survival, and reproduction

The testable hypothesis is that the reasonable maximum exposure (RME) concentrations of unit-related constituents present in soils, surface water, and sediment are not directly toxic to aquatic biota, soil invertebrates, small mammals, herbivorous mammals or indirectly toxic (e.g., through food chain uptake) to insectivorous birds. To verify or recant the testable hypothesis, receptor species are selected to represent the assessment endpoint and to aid in the selection of measurement endpoints. The most appropriate relationships of measurement endpoints to assessment endpoints are:

- knowledge of species in the habitats at the SRLSB OU
- estimates of receptor home range area, body weights, feeding rates, and dietary composition based on published measurements of endpoint species or similar species
- modeled COPC concentrations in the food chain based on measured concentrations in physical media

- most importantly, ecotoxicological effects such as chronic lowest observed adverse effects levels applicable to wildlife and aquatic receptors based on measured responses of similar species in laboratory studies.

Evaluation of the testable hypothesis resulted in the identification of only one final ecological COC. The ecological COC was chromium and applied only to surface soil in Basin 1 for soil dwelling biota. Therefore, of the five assessment endpoints discussed in chapter 6 of the RFI/RI/BRA/FCMS/FS (WSRC 1998a), only the first assessment endpoint (protection of soil invertebrates to ensure that ingestion of soil contaminants does not have a negative impact on growth, survival, and reproduction) is not met in surface soils of Basin 1.

Constituents of Concern and Human Health Risk-Based Remedial Goals

Human health RGs are estimates of protective remedial levels for COCs based on risk to human receptors. Ecological RGs are based on risks to ecological receptors. Contaminant migration RGs are based on risks from soil leaching to groundwater and on to human receptors. Final remedial levels for the COCs, selected by risk managers, are protective of both human health and ecological receptors and comply with federal and state ARARs. The RGs for contaminant migration, human health and ecological scenarios, and ARARs are discussed below.

Contaminant Migration Remedial Goals

Fate and transport analysis of the contaminants in the SRLSB soils predicts no future impact to the groundwater due to leaching and migration from the soils to the water table. Since no CMCOCs were identified, soil cleanup actions to protect groundwater are not necessary and no RGs were developed.

Human Health Remedial Goals

There were 21 human health final COCs identified for the future onsite resident: actinium-228, americium-241, cesium-137, cobalt-60, curium-243/244, curium-245/246, lead-212, neptunium-239, potassium-40, radium-228, plutonium-238, plutonium-239/240, strontium-90, thorium-228, thorium-230, thorium-232, uranium-233/234, uranium-235, uranium-238, mercury, and chromium (hexavalent). However, there were 20 human health final COCs for the future industrial worker scenario (curium-245/246 was not included). As a result, 20 RGs were established for the future industrial worker scenario based on a risk range of 1 x 10^{-6} through 1 x 1 0^{-4} and a hazard range of 0.1 through 0.3 as shown in Table 1. See Table 1 for a summary of the Remedial Goal Options (RGOs). The RGOs are shown as an indication of the contamination in the surface and subsurface soils for each of the four basins. See Table 2 for a summary of all final COCs.

Ecological RGs

Chromium in Basin 1 was the only ecological COC identified. An RG of 200 mg/kg was established for chromium in Basin 1 soils. This RG is protective for biota living in surface soils.

VIII. REMEDIAL ACTION OBJECTIVES AND REMEDIAL GOALS

Remedial action objectives (RAOs) specify COCs, media of concern, potential exposure pathways, and remediation goals. The RAOs are based on the nature and extent of contamination, threatened resources, and the potential for human and environmental exposure. Initially, preliminary remediation goals are developed based upon ARARs or other information from the RFI/RI report and the BRA.

Table 1. Summary of Human Health Remedial Goal Options for Risks Equal to 1 x 10^{-6} and HQ Equal to 0.1

Constituent	Target Hazard Quotient	Target Cancer Risk	Noncarcinogenic Effects Future Resident	Noncarcinogenic Effects Future Industrial Worker	Carcinogenic Effects Future Resident	Carcinogenic Effects Future Industrial Worker	RGO[1]	Max RME Value
INORGANICS (mg/kg) for risks equal to $1x10^{-6}$ and hazard quotient equal to **0.1**								
Mercury	0.1	$1x10^{-6}$	1	5	No CSF	No CSF	4.7	132
Chromium	0.1	$1x10^{-6}$	94	150	No CSF	No CSF	150	521
RADIONUCLIDES (pCi/g) for risks equal to 1 x 10^{-6} and hazard quotient equal to **0.1**								
Actinium-228	--	$1x10^{-6}$	--	--	0.013	0.07	0.07	444.00
Americium-241	--	$1x10^{-6}$	--	--	1.940	8.08	8.08	969.00
Cesium-137	--	$1x10^{-6}$	--	--	0.021	0.11	0.11	13,500.00
Cobalt-60	--	$1x10^{-6}$	--	--	0.004	0.02	0.02	5.69
Curium-243/244	--	$1x10^{-6}$	--	--	0.34	1.6	1.6	8,780.0
Curium-245/246	--	$1x10^{-6}$	--	--	3.5	17.5	17.5	3.5
Lead-212	--	$1x10^{-6}$	--	--	0.15	0.7	0.7	510.0
Neptunium-239	--	$1x10^{-6}$	--	--	0.18	0.9	0.9	9.1
Potassium-40	--	$1x10^{-6}$	--	--	0.07	0.4	0.4	36.4
Radium-228	--	$1x10^{-6}$	--	--	0.013	0.067	0.067	418.000
Plutonium-238	--	$1x10^{-6}$	--	--	2.680	10.857	10.857	494.000
Plutonium-239/240	--	$1x10^{-6}$	--	--	2.5100	10.130	10.130	7,780.000
Strontium-90	--	$1x10^{-6}$	--	--	14.2000	57.130	57.130	994.000
Thorium-228	--	$1x10^{-6}$	--	--	0.0070	0.035	0.035	494.000
Thorium-230	--	$1x10^{-6}$	--	--	21.1600	85.380	85.380	146.000
Thorium-232	--	$1x10^{-6}$	--	--	24.3	98	98	330
Uranium-233/234	--	$1x10^{-6}$	--	--	18	71	71	2,350
Uranium-235	--	$1x10^{-6}$	--	--	11.65	0.83	0.83	69.90
Uranium-238	--	$1x10^{-6}$	--	--	0.66	3.1	3.1	2,090.0

-- -Not applicable

[1] The most likely future land use is the future industrial worker scenario.

Table 1 Summary of Human Health Remedial Goal Options for Risks Equal to 1 x 10^{-5} and HQ Equal to 1.0 (Cont'd.)

Constituent	Target Hazard Quotient	Target Cancer Risk	Noncarcinogenic Effects – Future: Resident	Noncarcinogenic Effects – Future: Industrial Worker	Carcinogenic Effects – Future: Resident	Carcinogenic Effects – Future: Industrial Worker	RGO[1]	Max RME Value
INORGANICS (mg/kg) for risks equal to 1 x 10^{-5} and hazard quotient equal to 1.0								
Mercury	1	$1x10^{-5}$	12	47	No CSF	No CSF	47	132
Chromium	1	$1x10^{-5}$	940	1501	No CSF	No CSF	1501	521
RADIONUCLIDES (pCi/g) for risks equal to 1 x 10^{-5} and hazard quotient equal to 1.0								
Actinium-228	--	$1x10^{-5}$	--	--	0.130	0.67	0.67	444.00
Americium-241	--	$1x10^{-5}$	--	--	19.400	80.75	80.75	969.00
Cesium-137	--	$1x10^{-5}$	--	--	0.208	1.05	1.05	13,500.00
Cobalt-60	--	$1x10^{-5}$	--	--	0.044	0.23	0.23	5.69
Curium-243/244	--	$1x10^{-5}$	--	--	3.40	16.3	16.3	8,780.0
Curium-245/246	--	$1x10^{-5}$	--	--	35	175	175	3.5
Lead-212	--	$1x10^{-5}$	--	--	1.45	7.3	7.3	510.0
Neptunium-239	--	$1x10^{-5}$	--	--	1.80	9.1	9.1	9.1
Potassium-40	--	$1x10^{-5}$	--	--	0.70	36.0	36.0	36.4
Radium-228	--	$1x10^{-5}$	--	--	0.132	0.670	0.670	418.000
Plutonium-238	--	$1x10^{-5}$	--	--	26.800	108.570	108.570	494.000
Plutonium-239/240	--	$1x10^{-5}$	--	--	25.1000	101.300	101.300	7,780.000
Strontium-90	--	$1x10^{-5}$	--	--	142.0000	571.300	571.300	994.000
Thorium-228	--	$1x10^{-5}$	--	--	0.0699	0.350	0.350	494.000
Thorium-230	--	$1x10^{-5}$	--	--	211.6000	853.800	853.800	146.000
Thorium-232	--	$1x10^{-5}$	--	--	242.6	976	976	330
Uranium-233/234	--	$1x10^{-5}$	--	--	177	714	714	2,350
Uranium-235	--	$1x10^{-5}$	--	--	116.50	8.30	8.30	69.90
Uranium-238	--	$1x10^{-5}$	--	--	6.61	31.4	31.4	2,090.0

-- Not applicable
[1] The most likely future land use is the future industrial worker scenario.

Table 1. Summary of Human Health Remedial Goal Options for Risks Equal to 1 x 10^{-4} and HQ Equal to 3.0 (Cont'd.)

Constituent	Target Hazard Quotient	Target Cancer Risk	Noncarcinogenic Effects – Future: Resident	Noncarcinogenic Effects – Future: Industrial Worker	Carcinogenic Effects – Future: Resident	Carcinogenic Effects – Future: Industrial Worker	RGO[1]	Max RME Value
INORGANICS (mg/kg) for risks equal to 1 x 10^{-4} and hazard quotient equal to 3.0								
Mercury	3	$1x10^{-4}$	36	141	No CSF	No CSF	141	132
Chromium	3	$1x10^{-4}$	2820	4503	No CSF	No CSF	4503	521
RADIONUCLIDES (pCi/g) for risks equal to 1 x 10^{-4} and hazard quotient equal to 3.0								
Actinium-228	--	$1x10^{-4}$	--	--	1.300	6.70	6.70	444.00
Americium-241	--	$1x10^{-4}$	--	--	194.000	807.50	807.50	969.00
Cesium-137	--	$1x10^{-4}$	--	--	2.080	10.50	10.50	13,500.00
Cobalt-60	--	$1x10^{-4}$	--	--	0.440	2.25	2.25	5.69
Curium-243/244	--	$1x10^{-4}$	--	--	34.00	163.0	163.0	8,780.0
Curium-245/246	--	$1x10^{-4}$	--	--	350.0	1750.0	1750.0	3,5
Lead-212	--	$1x10^{-4}$	--	--	14.50	73.0	73.0	510.0
Neptunium-239	--	$1x10^{-4}$	--	--	18.00	91.0	91.0	9.1
Potassium-40	--	$1x10^{-4}$	--	--	7.00	360.0	360.0	36.4
Radium-228	--	$1x10^{-4}$	--	--	1.319	6.700	6.700	418.000
Plutonium-238	--	$1x10^{-4}$	--	--	268.000	1,085.700	1,085.700	494.000
Plutonium-239/240	--	$1x10^{-4}$	--	--	251.0000	1,013.000	1,013.000	7,780.000
Strontium-90	--	$1x10^{-4}$	--	--	1,420.0000	5,713.000	5,713.000	994.000
Thorium-228	--	$1x10^{-4}$	--	--	0.6994	3.500	3.500	494.000
Thorium-230	--	$1x10^{-4}$	--	--	2,116.0000	8,538.000	8,538.000	146.000
Thorium-232	--	$1x10^{-4}$	--	--	2,426.0	9,763	9,763	330
Uranium-233/234	--	$1x10^{-4}$	--	--	1,767	7,143	7,143	2,350
Uranium-235	--	$1x10^{-4}$	--	--	1,165.00	83.00	83.00	69.90
Uranium-238	--	$1x10^{-4}$	--	--	66.14	313.8	313.8	2,090.0

-- Not applicable

[1] The most likely future land use is the future industrial worker scenario.

Table 2. Final Human Health, Ecological, and Contaminant Migration COCs

Sub-Unit	Human Health COCs	Ecological COCs	Contaminant Migration COCs
	(Surface Soils: O-l foot Interval)		
SRL Basin 1	Actinium-228, Americium-241, Cesium-137, Cobalt-60, Curium-243/244, Lead-212, Potassium-40, Radium-228, Plutonium-238, Plutonium-239/240, Strontium-90, Thorium-228, Thorium-230, Thorium-232, Uranium-233/234, Uranium-235, Uranium-238, Mercury, Chromium (Hexavalent).	Chromium	None
SRL Basin 2	Actinium-228, Americium-241, Cesium-137, Cobalt-60, Curium-243/244, Neptunium-239, Potassium-40, Radium-228, Plutonium-238, Plutonium-239/240, Strontium-90, Thorium-228, Uranium-233/234, Uranium-235, Uranium-238. Mercury	None	None
SRL Basin 3	Cesium-137, Cobalt-60, Curium-243/244, Neptunium-239, Strontium-90, Uranium-235, Uranium-238.	None	None
SRL Basin 4	Cesium-137, Cobalt-60, Curium-243/244, Radium-228, Strontium-90, Thorium-228, Uranium-235, Uranium-238.	None	None

Table 2. Final Human Health, Ecological, and Contaminant Migration COCs (Cont'd.)

Sub-Unit	Human Health COCs	Ecological COCs	Contaminant Migration COCs
	(Subsurface Soils: 0-4 feet Interval)		
SRL Basin 1	Actinium-228, Americium-241, Cesium-137, Cobalt-60, Curium-243/244, Lead-212, Potassium-40, Radium-228, Plutonium-238, Plutonium-239/240 Strontium-90, Thorium-228, Thorium-230, Thorium-232, Uranium-233/234, Uranium-235, Uranium-238, Mercury, Chromium (Hexavalent).	None	None
SRL Basin 2	Actinium-228, Americium-241, Cesium-137, Cobalt-60, Curium-243/244, Neptunium-239, Potassium-40, Radium-228, Plutonium-239/240, Strontium-90, Thorium-228, Uranium-235, Uranium-238.	None	None
SRL Basin 3	Cesium-137, Cobalt-60, Curium-243/244, Neptunium-239, Strontium-90, Uranium-235, Uranium-238.	None	None
SRL Basin 4	Cesium-137, Cobalt-60, Curium-243/244, Radium-228, Strontium-90, Thorium-228, Vanadium, Uranium-235, Uranium-238.	None	None

These goals are modified, as necessary, as information concerning the unit and potential remedial technologies becomes available. Final remediation goals are determined when the remedy is selected and are used to establish acceptable exposure levels protective of human health and the environment.

ARARs are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal, state, or local environmental law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Three types of ARARs (action-, chemical-, and location-specific) have been developed to simplify identification and compliance with environmental requirements. Action-specific requirements set controls on the design, performance, and other aspects of implementation of specific remedial activities. Chemical-specific requirements are media-specific and health-based concentration limits developed for site-specific levels of constituents. Location-specific ARARs reflect the physiographical and environmental characteristics of the unit or the immediate area. The action-specific, location-specific, or chemical-specific ARARs relevant to all the different alternatives are listed in Appendix A.

The RFI/RI and BRA indicate that the secondary sources (i.e., basin soil) associated with the SRLSB OU pose significant carcinogenic risk to human health. Only one final ecological COC, chromium, was found in the surface soils of Basin 1. Based on these conclusions, the FCMS/FS was conducted to consider possible actions for reducing the risks associated with the SRLSB OU.

Based on the risks posed, the RAO for the SRLSB is to ensure the protection of human health and the environment. The human health RAOs for the SRLSB are:

- Eliminate exposure of the future industrial worker to radiochemical, mercury and chromium contamination in surface soils of Basins 1, 2, 3, and 4.

- Remove all principal threat source material from Basins 1, 2, and 3.

The ecological RAO for the SRLSB is to reduce risk to soil invertebrates from ingestion of chromium in the surface soils of Basin 1.

The predominant COCs at the SRLSB OU are radionuclides in the basin soils for human receptors and chromium in Basin 1 soils for ecological receptors. Tables in Section VII summarize the risk posed by SRL Seepage Basin soils and illustrate that the majority of the risk is attributable to direct external radiation.

The final list of human health COCs for the future industrial worker scenario includes 18 radionuclides and 2 metals. RGs were established for the industrial worker scenario based on a risk of 1 x 10^{-6} or an HQ of 1.0.

Principal threat source material is defined as source material that is highly toxic or mobile at levels that pose a risk to human health greater than 1 x 10^{-3} should exposure occur.

Final Human Health Industrial RGs for the SRLSB Soil

Final COC	Units	RG
Actinium-228	pCi/g	0.07
Americium-241	pCi/g	8.08
Cesium-137	pCi/g	0.11
Cobalt-60	pCi/g	0.02
Curium-243/244	pCi/g	1.6
Lead-212	pCi/g	0.7
Neptunium-239	pCi/g	0.9
Plutonium-238	pCi/g	10.857
Plutonium-239/240	pCi/g	10.130
Potassium-40	pCi/g	0.4
Radium-228	pCi/g	0.067
Strontium-90	pCi/g	57.130
Thorium-228	pCi/g	0.035
Thorium-230	pCi/g	85.38
Thorium-232	pCi/g	98.0
Uranium-233/234	pCi/g	71.0
Uranium-235	pCi/g	0.83
Uranium-238	pCi/g	3.1
Hexavalent Chromium	mg/kg	1501
Mercury	mg/kg	47.0

Chromium in Basin 1 was the only ecological COC identified. To be protective of environmental receptors, an RG of 200 mg/kg was established for chromium.

IX. DESCRIPTION OF ALTERNATIVES

A preliminary list of treatment technologies potentially applicable to contamination associated with radioactive basins at SRS was developed. Technical merits and limitations of each technology and general response actions were evaluated. The technologies were also evaluated for their effectiveness in addressing chromium. The results indicated that the preferred remedial response/technology is soil removal and backfilling with an earthen cover. The results, coupled with current guidance, provided the basis for screening and identifying technologies applicable to radioactive contaminants and facilitated the selection of a preferred remedial alternative for the SRLSB OU.

The secondary sources pose the majority of the unit risk and include the SRLSB soils. The FCMS/FS includes detailed analyses of six SRL Seepage Basin soils alternatives, which are described below. Included with the secondary source alternatives are remedial activities to address the contaminated soil in the basins and basin berms.

Secondary Source Alternatives For SRLSB OU

Alternative S-l. No Action

Estimated Cost - $70,000

Construction Time to complete -- 0 months

The National Oil and Hazardous Substances Contingency Plan (NCP) requires that the No Action alternative be retained through the FCMS/FS to provide a basis for comparison during the analysis of alternatives. Under this alternative, no remedial efforts would be conducted to remove, treat, or otherwise lessen the

toxicity, mobility, or affected volume of contaminated media. Institutional controls similar to those that already exist (fencing, groundwater monitoring and maintenance) would not continue under the No Action scenario.

The No Action alternative would not be protective of human health because of risk of soil ingestion by a hypothetical future resident and would not be protective of the environment.

The NCP requires 5-year remedy reviews for all sites where waste is left in place above levels that would allow unlimited use and unrestricted exposure. Costs associated with a No Action alternative include the completion and reporting of six separate 5-year remedy reviews over a 30-year period. This cost is in present value dollars, which is an estimate of an inflation-adjusted minimum amount of funding needed today to meet the financial requirements at times in the future – in this case every five years for 30 years.

Alternative S-2. Construct Multi-Layer, RCRA-Style Cap over Basins 1 and 2

Estimated Cost - $740,000

Construction Time to complete – 6 months

Remedy Components of Alternative S-2

- Alternative S-2 does not provide treatment of the principal threat source material in the unit soil above the 1 x 10^{-3} risk level to reduce toxicity or volume of contamination.
- Alternative S-2 entails construction of a multi-layer, RCRA-style cap over Basins 1 and 2 to contain the contamination and reduce human and environmental exposure. The synthetic membrane cap would extend over the entire area of the two basins, covering approximately 0.6 acres (26,100 square feet). Any soil in Basin 3 or 4 above 1×10^{-3} industrial risk would be moved to

Basins 1 and 2. Basins 3 and 4 would be filled with structural backfill to original grade or higher. The process sewer pipeline and associated soils would be excavated and placed in Basins 1 and 2 prior to backfilling. The cap and cover would eliminate all risk pathways and meet RGs. Since contamination will remain at the unit, a 5-year remedy review would be required. The permanence of this remedy depends on the installation and maintenance of the RCRA-style cap.

- Institutional controls would remain in place and preclude residential development and disturbance of the cap. A unit-specific land use control implementation plan (LUCIP) would be developed for this alternative.
- Alternative S-2 provides no facilities that require operation. Maintenance activities would include routine inspection and repair (as necessary), grass mowing of the cap and closed basins, estimated at four times per year.
- Although contained and isolated from human and ecological receptors, all principal threat source material (approximately 3207 m^3) would remain at the unit.
- Upon construction completion (approximately 6 months after the start of remedial action) the land would be available for industrial use.
- Key ARARs associated with Alternative S-2 are:
  - ❖ 10 CFR 61.42 – Provides performance standards to ensure protection of any individual inadvertently intruding into the area.
  - ❖ SC R61-79.310 – Federal and State Hazardous Waste Regulations
  - ❖ SC R.72-300 – Stormwater management and sediment control plan for land disturbances.

- Groundwater remediation of volatile organic compounds in the area of the SRL Seepage Basins as a result of other release points in the A/M Area is being managed under the RCRA Part B Permit for the M-Area Hazardous Waste Management Facility.

Alternative S-3. Solidification/In Situ Stabilization of Soils above 1 x 1 0^{-3} Industrial Risk – Earthen Cover

Estimated Cost - $2,520,000

Construction Time to complete – 7 months

Remedy Components of Alternative S-3

- Alternative S-3 provides solidification/stabilization of the principal threat source material in the unit, identified as soil above the 1 x 10^{-3} industrial risk level. The estimated volume of the surface and subsurface soil that exceeds the 1 x 10^{-3} industrial risk level is 3,207 m^3. The volume of contaminants would be mixed in situ with a cement grout. Assuming a final solids matrix of 50% soil and 50% solidification additives, the volume of waste remaining at the unit would be approximately 6414 m^3. Although the mobility of the contamination would be reduced, the toxicity of the contamination would not be reduced. The process sewer pipeline and associated soils would be excavated and placed in the basins prior to solidification/stabilization.

- Alternative S-3 entails construction of a soil cover over the stabilized material to provide a barrier to surface exposure and deter access to the contaminants. The soil cover would be placed and graded to provide structural barriers (minimum of 9 feet) and would extend over all four basins to contain the contamination and reduce human and environmental exposure. The cover would eliminate all risk pathways and meet RGs. The permanence of this remedy depends on the stabilization strategy in combination with the

installation and maintenance of the earthen cover. Since contamination will remain at the unit, a 5-year remedy review would be required.

- Institutional controls would remain in place and preclude residential development and disturbance of the cover. A unit-specific LUCIP would be developed for this alternative.

- Alternative S-3 provides no facilities that require operation. Maintenance of the cover would involve routine inspection and repair (as necessary) and grass mowing of the cover and closed basins, estimated at four times per year, as with Alternative S-2.

- Upon construction completion (approximately 7 months after the start of remedial action) the land would be available for industrial use.

- Key ARARs associated with Alternative S-3 are:

  - 10 CFR 61.42 – Provides performance standards to ensure protection of any individual inadvertently intruding into the area.

  - 10 CFR 835 – Establishes radiation protection for individuals during US DOE activities.

  - SC R.72-300 – Stormwater management and sediment control plan for land disturbances.

- Groundwater remediation of volatile organic compounds in the area of the SRL Seepage Basins as a result of other release points in the A/M Area is being managed under the RCRA Part B Permit for the M-Area Hazardous Waste Management Facility.

Alternative S-5: Excavate Soil, Dispose of Off SRS - Earthen Cover

Estimated Cost – S-5A $1,900,000; S-5B is $3,550,000

Construction Time to complete – S-5A is 8 months; S-5B is 18 months.

Remedy Components of Alternative S-5

- Alternative S-5A provides for excavation and removal of approximately 918 m^3 of the principal threat source material (soil above the 1 x 10^{-3} industrial risk level) by removal of the O-l foot soil interval in Basins 1 and 2 and disposal at a licensed off-SRS facility. The remaining principal threat source material (approximately 2289 m^3) would be chemically treated by incorporation of soil additives or reactive chemical barriers that reduce the mobility of contaminants. The remaining contamination toxicity would not be reduced. Assuming a final solids matrix of 50% soil and 50% additives, the volume of waste remaining at the unit would be approximately 4578 m^3.

  Alternative S-5B provides for excavation, removal and disposal of all principal threat source material (soil above 1 x 10^{-3} industrial risk) at a licensed off-SRS facility.' Approximately 3207 m^3 of soil would be removed.

- Alternatives S-5A and S-5B employ an earthen cover, which would be placed and graded to provide a structural fill barrier (minimum of 9 feet). The earthen cover would extend over all four basins to contain the contamination and reduce human and environmental exposure. The cover would eliminate all risk pathways and meet RGs. The permanence of this remedy depends on the stabilization strategy in combination with the installation and maintenance of the earthen cover. Since contamination will remain at the unit, a 5-year remedy review would be required.

- Institutional controls would remain in place and preclude residential development and disturbance of the cover. A unit-specific LUCIP would be developed for this alternative.

- Alternatives S-5A and S-5B provide no facilities that require operation. Maintenance activities would include annual routine inspection and repair (as

necessary) and grass mowing of the cover and closed basins, estimated at four times per year.

- Upon construction completion (approximately 8 months after the start of remedial action for S-5A or approximately 18 months after the start of remedial action for S-5B) the land would be available for industrial use.
- Key ARARs associated with Alternative S-5 are:
  - 40 CFR 50.6 and SC R.61-62.5 Standard 2 Ambient Air Quality Standards - Provide ambient air particulate concentration limits.
  - SC R.61-62.6 Fugitive Particulate Matter - Provides requirements for controlling fugitive airborne particulates.
  - SC R.72-300 Standards for Stormwater Management and Sediment Reduction - Requires a stormwater management and sediment control plan.
  - 49 CFR 107, 171-179 DOT Hazardous Materials Transportation Regulators - Specifies requirements for handling, packaging, labeling, and transporting DOT hazardous substances.
- Groundwater remediation of volatile organic compounds in the area of the SRL Seepage Basins as a result of other release points in the A/M Area is being managed under the RCRA Part B Permit for the M-Area Hazardous Waste Management Facility.

Alternative S-6: Excavate Soil, Dispose of on SRS (LLWDF) - Earthen Cover

Estimated Cost – 6A is $1,770,000; 6B is $3,030,000; 6C is $9,800,000; 6D is $12,530,000

Construction Time to complete - 6A is 8 months; 6B is 14 months; 6C is 22 months; 6D is 30 months

Remedy Components of Alternative S-6

- Alternative S-6A provides for excavation and removal of approximately 918 m^3 of the principal threat source material (soil above the 1 x 10^{-3} industrial risk level) by removal of the O-l foot soil interval in Basins 1 and 2 and disposal at the SRS LLWDF. The remaining principal threat source material (approximately 2289 m^3) would be chemically treated by incorporation of soil additives or reactive chemical barriers that reduce the mobility of contaminants. The remaining contamination toxicity would not be reduced. Assuming a final solids matrix of 50% soil and 50% additives, the volume of waste remaining at the unit would be approximately 4578 m^3.

  Alternative S-6B provides excavation, removal, disposal, and treatment of all principal threat source material (soil above 1 x 10^{-3} industrial risk) at the SRS LLWDF, thus reducing contaminant volume, and treatment of all principal threat source material. Approximately 3207 m^3 of soil would be removed.

  Alternative S-6C provides excavation, removal and disposal at the SRS LLWDF of all soil above 1 x 10^{-4} industrial risk level, thus reducing contaminant volume, and treatment of all principal threat source material. Approximately 16,240 m^3 of soil would be removed.

  Alternative S-6D provides excavation, removal and disposal at the SRS LL WDF of all soil above 1 x 10^{-4} residential risk level, thus reducing contaminant volume, and treatment of all principal threat source material. Approximately 19,214 m^3 of soil would be removed.

- All four subalternatives employ an earthen cover, which would be placed and graded to provide a structural fill barrier (minimum of 9 feet). The earthen cover would extend over all four basins to contain the contamination and

reduce human and environmental exposure. The cover would eliminate all risk pathways and meet RGs. A 5-year remedy review would be required.

- Institutional controls would remain in place and preclude residential development and disturbance of the cover. A unit-specific LUCIP would be developed for this alternative.

- No subalternatives provide facilities that require operation. Maintenance activities would include routine inspection and repair (as necessary) and grass mowing of the cover and closed basins, estimated at four times per year.

- Upon construction completion (approximately 8 months after the start of remedial action for S-6A, or approximately 14 months for S-6B, or approximately 22 months for S-6C) the land would be available for industrial use. For Alternative S-6D, the land would be available for residential use approximately 30 months after the start of remedial action.

- Key ARARs associated with Alternative S-6 are:

  ❖ 10 CFR 61.42 – Provides performance standards to ensure protection of any individual inadvertently intruding into the area.

  ❖ 10 CFR 61.50 – Licensing Requirements for Land Disposal of Radioactive Waste.

  ❖ SC R.72-300 – Stormwater management and sediment control plan for land disturbances.

- Groundwater remediation of volatile organic compounds in the area of the SRL Seepage Basins as a result of other release points in the A/M Area is being managed under the RCRA Part B Permit for the M-Area Hazardous Waste Management Facility.

Alternative S-7: Excavate Soil, Dispose of on SRS at the C-Reactor Seepage Basin- Earthen Cover

Estimated Cost – 7A is $2,360,000; 7B is $3,690,000

Construction Time to complete – 7A is 10 months; 7B is 16 months

Remedy Components of Alternative S-7

- Alternative S-7A provides for excavation and removal of approximately 918 m^3 of the principal threat source material (soil above the 1 x 10^{-3} industrial risk level) by removal of the O-l foot soil interval in Basins 1 and 2 and disposal at the C-Reactor Seepage Basin (CRSB). The remaining principal threat source material (approximately 2289 m^3) would be chemically treated by incorporation of soil additives or reactive chemical barriers that reduce the mobility of contaminants. The remaining contamination toxicity would not be reduced. Assuming a final solids matrix of 50% soil and 50% additives, the volume of waste remaining at the unit would be approximately 4578 m^3.

  Alternative S-7B provides excavation, removal, disposal, and treatment of all principal threat source material (soil above 1 x 10^{-3} industrial risk) at the CRSB, thus reducing contaminant volume, and treatment of all principal threat source material. Approximately 3207 m^3 of soil would be removed.

- Both alternatives S-7A and S-7B employ an earthen cover, which would be placed and graded to provide a structural fill barrier (minimum of 9 feet). The earthen cover would extend over all four basins to contain the contamination and reduce human and environmental exposure. The cover would eliminate all risk pathways and meet RGs. Since contamination will remain at the unit, a 5-year remedy review would be required.

- Institutional controls would remain in place and preclude residential development and disturbance of the cover. A unit-specific LUCIP would be developed for this alternative.

- Alternatives S-7A and S-7B provide no facilities that require operation. Maintenance activities would include routine inspection and repair (as necessary) and grass mowing of the cover and closed basins, estimated at four times per year.

- Upon construction completion (approximately 10 months after the start of remedial action for S-7A, or approximately 16 months for S-7B) the land would be available for industrial use.

- Key ARARs associated with Alternative S-7 are:

  - 10 CFR 61.42 – Provides performance standards to ensure protection of any individual inadvertently intruding into the area.

  - 10 CFR 61 SO – Licensing Requirements for Land Disposal of Radioactive Waste.

  - SC R.72-300 – Stormwater management and sediment control plan for land disturbances.

- Groundwater remediation of volatile organic compounds in the area of the SRL Seepage Basins as a result of other release points in the A/M Area is being managed under the RCRA Part B Permit for the M-Area Hazardous Waste Management Facility.

X. COMPARATIVE ANALYSIS OF ALTERNATIVES

Each of the remedial alternatives was evaluated using the nine criteria established by the NCP. The criteria were derived from the statutory requirements of CERCLA Section 121. The criteria are listed below:

- overall protection of human health and the environment,

- compliance with ARARs,

- long-term effectiveness and permanence,
- reduction of toxicity, mobility, or volume through treatment,
- short-term effectiveness,
- implementability,
- cost,
- state acceptance, and
- community acceptance.

In selecting the preferred alternative, the first seven criteria were used to evaluate the alternatives developed in the FCMS/FS (WSRC 1998a). The preferred alternative will be further evaluated based on the final two criteria: state acceptance and community acceptance.

Table 3 presents a comparative analysis of SRLSB soil alternatives versus the first seven criteria.

State Acceptance

The state is requested to comment on the RFI/RI Report, the BRA, the FS, and the PP. The state's concurrence or opposition to the preferred alternative is considered. This criterion will be achieved through approval of this ROD.

Table 3. Comparative Analysis of SRLSB Soil Alternatives

Criterion	Alternative S-1 No Action	Alternative S-2 Multi-her RCRA-style Cap over Basins 1 & 2	Alternative S-3 In Situ Stabilization/Solidification/Cover	Alternative S-5A Soil Excavation (O-1 ft Basins 1&2)/Disposal Off-SRS/Cover	Alternative S-5B Soil Excavation (1×10^{-3} Industrial Risk)/Disposal Off SRS/Cover
Overall Protectiveness					
Human Health	Not Protective	Protective	Protective	Protective	Protective
Environment	Not Protective	[Protective	Protective	Protective	(Protective
Compliance with ARARs					
Chemical-specific	None	10 CFR 835 Occupational Radiation Protection will be met.	10 CFR 835 Occupational Radiation Protection will be met.	40 CFR 61.92 NESHAPS & 10 CFR 835 Occupational Radiation Protection will be met.	40 CFR 61.92 NESHAPS & 1 C CFR 835 Occupational Radiation Protection will be met.
Location-Specific	lone	IO CFR 61.50 Licensing Requirements for Land Disposal of Radioactive Waste -relevant and appropriate	10 CFR 61.50 Licensing Requirements for Land Disposal of Radioactive Waste – relevant and appropriate	16 USC 661 and Executive Order 11990 will be met.	16 USC 661 and Executive Order 11990 will be met.
Action-Specific	Not applicable	IO CFR 61.42 and 10 CFR 61.53 are relevant and appropriate & will be met. The design will comply with 40 CFR 264.310, SC R61-79.310 Federal and State Hazardous Waste Regulations	10 CFR 61.42 and 10 CFR 61.53 are relevant and appropriate & will be met.	40 CFR 50.6, SC R.61-62.5 Standard 2 Ambient Air Quality Standards, SC R.61-62.6 Fugitive Particulate Matter, SC R.61-9 NPDES Permits, SC R.72-300 Standards for Stormwater Management and Sediment Reduction, 40 CFR 107, 171-179 DOT Hazardous Materials Transportation (Regulation will be met.	40 CFR 50.6, SC R.61-62.5 Standard 2 Ambient Air Quality Standards, SC R.61-62.6 Fugitive Particulate Matter, SC R.61-9 NPDES Permits, SC R.72-300 Standards for Stormwater Management and Sediment Reduction, 40 CFR 107, 171-179 DOT Hazardous Materials Transportation Regulation will be met.

Table 3 Comparative Analysis of SRLSB Soil Alternatives (Cont'd.)

Criterion	Alternative S-1 No Action	Alternative S-2 Multi-layer RCRA-style Cap over Basins 1 & 2	Alternative S-3 In Situ Stabilization/Solidification/Cover	Alternative S-5A Soil Excavation (0-1 ft Basins 1&2)/Disposal Off-SRS/Cover	Alternative S-5B Soil Excavation (1×10^{-3} Industrial Risk)/ Disposal Off-SRS/Cover
Long-term Effectiveness and Permanence					
Magnitude of residual risks	Residual risks would be high, particularly in the absence of institutional controls.	Much reduced over current conditions. All principal threat source material remains at the OU, although it is covered to prevent exposure, near the SRS boundary.	Much reduced over current conditions. All principal threat source material remains at the OU, although it is covered to prevent exposure, near the SRS boundary.	Residual risk at SRLSB would be low because the most contaminated soils would be removed and relocated to an off-SRS disposal facility such as Envirocare of Utah, Inc.; residual principal threat source material at SRLSB would be treated to reduce mobility, and all contaminant pathways at SRLSB would be eliminated.	Residual risk at SRLSB would be low: all contaminant pathways at SRLSB would be eliminated; all principal threat source material would be removed and relocated to an off-SRS disposal facility such as Envirocare of Utah, Inc.
Adequacy of Controls	Not Adequate	Existing and additional institutional controls needed for effectiveness; cap will provide exposure barrier only as long as integrity is maintained. All contaminant pathways would be eliminated.	Existing and additional institutional controls needed for effectiveness; cover and grout will provide exposure barrier. All contaminant pathways would be eliminated.	Minimal institutional controls required. All contaminant pathways would be eliminated.	Minimal institutional controls required. All contaminant pathways would be eliminated.

Table 3. Comparative Analysis of SRLSB Soil Alternatives (Cont'd.)

Criterion	Alternative S-1 No Action	Alternative S-2 Multi-layer RCRA-style Cap over Basins 1 & 2	Alternative S-3 In Situ Stabilization/Solidification/Cover	Alternative S-5A Soil Excavation (O-1 ft Basins 1&2)/ Disposal Off-SRS/Cover	Alternative S-5B Soil Excavation (1×10^{-3} Industrial Risk)/ Disposal Off-SRS/Cover
Reduction of Toxicity, Mobility, or Volume Through Treatment					
Treatment Type	No treatment	No treatment	Stabilization/solidification of principal threat source material.	Treatment to reduce mobility for residual principal threat source material at SRLSB; no treatment for soils disposed of off-SRS.	No treatment
Reduction of Toxicity, Mobility, or Volume	None	Capping would effectively reduce contaminant mobility.	Permanently reduce contaminant mobility.	Most highly contaminated soils removed, but relocated off SRS; permanently reduce mobility of residual principal threat source material at the SRLSB.	All principal threat source material (1×10^{-3} industrial risk) soils removed, but relocated to an off-SRS disposal facility such as Envirocare of Utah, Inc.
Short-Term Effectiveness					
Risk to remedial workers	None	Minimal	Low; minimal handling of contaminated soils.	Medium; 918 cubic meters of soils excavated and transported.	Medium to high; 3,207 cubic meters of soils excavated and transported.
Risk to Community	Negligible	Minimal	Minimal	Medium to high; transport off SRS on public rights of way.	Medium to high; transport off SRS on public rights of way.
Construction Schedule	Immediately Implementable	6 months	7 months	8 months	18 months

Table 3. Comparative Analysis of SRLSB Soil Alternatives (Cont'd.)

Criterion	Alternative S-1 No Action	Alternative S-2 Multi-layer RCRA-style Cap over Basins 1 & 2	Alternative S-3 In Situ Stabilization/Solidification/Cover	Alternative S-5A Soil Excavation (0-1 ft Basins 1&2)/ Disposal Off-SRS/Cover	Alternative S-5B Soil Excavation (1×10^{-3} Industrial Risk)/ Disposal Off-SRS/Cover
Implementability					
Potential Concerns	Potential for public concern if no action is implemented.	Potential for public concern because contaminants stay in place. Would make future remedial actions, if warranted, more difficult	Potential for public concern because contaminants stay in place.	High; involves additional handling of materials, loading and packaging for shipment, potential future need for treatment at an off-SRS disposal facility such as Envirocare of Utah, Inc., permits for shipment.	High; involves additional handling of materials, loading and packaging for shipment, potential future need for treatment at an off-SRS disposal facility such as Envirocare of Utah, Inc., permits for shipment.
Relative Implementability	Readily implementable	Readily implementable, but would require much more effort than No Action.	Readily implementable, but would require more effort than capping alone.	Implementable. Off-SRS facilities such as Envirocare of Utah, Inc. are designed to accept low-level wastes under established procedures and administrative controls.	Implementable. . Off-SRS facilities such as Envirocare of Utah, Inc. are designed to accept low-level wastes under established procedures and administrative controls.
Cost					
	$70,000	$740,000	$2,520,000	$1,900,000	$3,550,000

Table 3. Comparative Analysis of SRLSB Soil Alternatives (Cont'd.)

Criterion	Alternative S-GA Soil Excavation (0-1 ft Basins 1&2)/Disposal On-SRS (LLWDF)/Cover	Alternative S-6B Soil Excavation (1×10^{-3} Industrial Risk) /Disposal On-SRS (LLWDF)/Cover	Alternative S-6C Soil Excavation (1×10^{-4} Industrial Risk)/Disposal On-SRS (LLWDF)/Cover	Alternative S-6D Soil Excavation (1×10^{-4} Residential Risk)/Disposal On-SRS (LLWDF)/Cover	Alternative S-7A Soil Excavation (O-1 ft Basins 1&2)/Disposal On-SRS (CRSB)/Cover	Alternative S-7B Soil Excavation (1×10^{-3} Industrial Risk)/Disposal On-SRS (CRSB)/Cover
Overall Protectiveness						
Human Health	Protective	Protective	Protective	Protective	Protective	Protective
Environment	Protective	Protective	Protective	Protective	Protective	Protective
Compliance with ARARs						
Chemical-Specific	None	None	None	None	None	None
Location-Specific	10 CFR 61.50 Licensing Requirements for Land Disposal of Radioactive Waste – relevant and appropriate	10 CFR 61.50 Licensing Requirements for Land Disposal of Radioactive Waste -relevant and appropriate	10 CFR 61.50 Licensing Requirements for Land Disposal of Radioactive Waste – relevant and appropriate	10 CFR 61.50 Licensing Requirements for Land Disposal of Radioactive Waste – relevant and appropriate	10 CFR 61.50 Licensing Requirements for Land Disposal of Radioactive Waste – relevant and appropriate	10 CFR 61.50 Licensing Requirements for Land Disposal of Radioactive Waste-relevant and appropriate
Action-Specific	10 CFR 61.42and 10 CFR 61.53 are relevant and appropriate & will be met.	10 CFR 61.42and 10 CFR 61.53 are relevant and appropriate & will be met.	10 CFR 61.42and 10 CFR 61.53 are relevant and appropriate & will be met.	10 CFR 61.42and 10 CFR 61.53 are relevant and appropriate & will be met.	10 CFR 61.42and 10 CFR 61.53 are relevant and appropriate & will be met.	10 CFR 61.42and 10 CFR 61.53 are relevant and appropriate & will be met.

Table 3. Comparative Analysis of SRLSB Soil Alternatives (Cont'd.)

Criterion	Alternative S-6A Soil Excavation (O-1 ft Basins 1&2)/Disposal On-SRS (LLWDF)/Cover	Alternative S-6B Soil Excavation (1×10^{-3} Industrial Risk) /Disposal On-SRS (LLWDF)/Cover	Alternative S-6C Soil Excavation (1×10^{-4} Industrial Risk)/Disposal On-SRS (LLWDF)/Cover	Alternative S-6D Soil Excavation (1×10^{-4} Residential Risk)/Disposal On-SRS (LLWDF)/Cover	Alternative S-7A Soil Excavation (O-1 ft Basins 1&2)/Disposal On-SRS (CRSB)/Cover	Alternative S-7B Soil Excavation (1×10^{-3} Industrial Risk)/Disposal On-SRS (CRSB)/Cover
Long-term Effectiveness and Permanence						
Magnitude of residual risks	Residual risk at SRLSB would be low; the most contaminated soils would be removed and relocated to a facility designed to accept low-level waste; residual principal threat source material at SRLSB would be treated to reduce mobility, and all contaminant pathways at SRLSB would be eliminated.	Residual risk at SRLSB would be low; all contaminant pathways at SRLSB would be eliminated; all principal threat source material would be removed, treated, and relocated to a facility designed to accept low-level waste.	Residual risk at SRLSB would be minimal; all contaminant pathways at SRLSB would be eliminated; all soils above 1×10^{-4} industrial risk would be removed, and relocated to a facility designed to accept low-level waste; all principal threat source material would be treated prior to disposal.	Residual risk at SRLSB would be minimal; all contaminant pathways at SRLSB would be eliminated; all soils above 1×10^{-4} residential risk would be removed, and relocated to a facility designed to accept low-level waste; all principal rat source material ould be treated prior to isposal.	Residual risk at SRLSB would be low; the most contaminated soils would be removed, residual principal threat source material would be treated to reduce mobility, and all contaminant pathways eliminated. At CRSB, long-term risk is substantially changed due to the radionuclide inventory from SRLSB. Activity levels are approximately 1.5 orders of magnitude higher than the current activity levels at CRSB. The time to decay to near background will change from a few hundred years to millions of years.	Residual risk at SRLSB would be low; all principal threat source material would be removed, and all contaminant pathways eliminated. At CRSB, long-term risk is substantially changed due to the radionuclide inventory from SRLSB. Activity levels are approximately 1.5 orders of magnitude higher than the current activity levels at CRSB. The time to decay to near background will change from a few hundred years to millions of years. Would require expansion of the, principal threat source material footprint at the CRSB OU.
Adequacy of Controls	Minimal institutional controls required. All ntaminant pathways ould be eliminated.	Minimal institutional controls required. All contaminant pathways would be eliminated.	Minimal institutional controls required. All contaminant pathway: would be eliminated.	Minimal institutional controls required. All ntaminant pathways ould be eliminated.	Minimal institutional controls required at SRLSB. All contaminant pathways would be eliminated at SRLSB. Controls at CRSB would require enhancement.	Minimal institutional controls required at SRLSB. All contaminant pathways would be eliminated at SRLSB. Controls at CRSB would require enhancement

Table 3. Comparative Analysis of SRLSB Soil Alternatives (Cont'd.)

Criterion	Alternative S-6A Soil Excavation (O-l ft Basins 1&2)/Disposal On-SRS (LLWDF)/Cover	Alternative S-6B Soil Excavation (1×10^{-3} Industrial Risk) /Disposal On-SRS (LLWDF)/Cover	Alternative S-6C Soil Excavation (1×10^{-4} Industrial Risk)/Disposal On-SRS (LLWDF)/Cover	Alternative S-6D Soil Excavation (1×10^{-4} Residential Risk)/Disposal On-SRS (LLWDF)/Cover	Alternative S-7A Soil Excavation (O-l ft Basins 1&2)/Disposal On-SRS (CRSB)/Cover	Alternative S-7B Soil Excavation (1×10^{-3} Industrial Risk)/Disposal On-SRS (CRSB)/Cover
Reduction of Toxicity, Mobility, or Volume Through Treatment						
Treatment Type	Treatment to reduce mobility for residual principal threat source material at SRLSB and for soil disposed of at LLWDF.	Treatment to reduce mobility for principal threat source material at LLWDF.	Treatment to reduce mobility for principal threat source material at LLWDF.	Treatment to reduce mobility for principal threat source material at LLWDF.	Treatment to reduce mobility for residual principal threat source material at SRLSB and for soils at CRSB.	Treatment to reduce mobility for principal threa source material at CRSB.
Reduction of Toxicity, Mobility, or Volume	Most highly contaminated soils removed, treated to reduce mobility, and relocated at LLWDF; reduce mobility of residual contamination at the SRLSB. All principal threat source material treated to reduce contaminant mobility.	All principal threat source material (1×10^{-3} industrial risk) soils removed, treated to reduce mobility, and relocated at LLWDF.	All soils above 1×10^{-4} industrial risk removed, and relocated at LLWDF; principal threat source material (1×10^{-3} industrial risk) treated to reduce mobility.	All soils above 1×10^{-4} residential risk removed, and relocated at LLWDF; principal threat source material (1×10^{-3} industrial risk) treated to reduce mobility.	Most highly contaminated soils removed, treated to reduce mobility, and relocated at CRSB; reduce mobility of residual contamination at the SRLSB. All principal threat source material treated to reduce contaminant mobility.	All principal threat source material (1×10^{-3} industrial risk) soils removed, treated to reduce mobility, and relocated at CRSB.
Short-Term Effectiveness						
Risk to remedial workers	Low to medium; 918 cubic meters of soils excavated and transported.	Medium; 3,207 cubic meters of soils excavated and transported.	High; 16,240 cubic meters of soils excavated and transported, depth of excavation increased to 3 1 A below grade.	High; 19,214 cubic meters of soils excavated and transported, depth of excavation increased to 3 1 ft below grade.	Medium; 918 cubic meters of soils excavated and transported.	Medium to high; 3,207 cubic meters of soils excavated and transported.
Risk to Community	Minimal.	Minimal.	Minimal.	Minimal.	Minimal.	Minimal.
Construction Schedule	8 months	14 months	22 months	30 months	10 months	16 months

Table 3. **Comparative Analysis of SRLSB Soil Alternatives (Cont'd.)**

Criterion	Alternative S-6A Soil Excavation (O-l ft Basins 1&2)/Disposal On-SRS (LLWDF)/Cover	Alternative S-6B Soil Excavation (1×10^{-3} Industrial Risk) /Disposal On-SRS (LLWDF)/Cover	Alternative S-6C Soil Excavation (1×10^{-4} Industrial Risk)/Disposal On-SRS (LLWDF)/Cover	Alternative S-6D Soil Excavation (1×10^{-4} Residential Risk)/Disposal On-SRS (LLWDF)/Cover	Alternative S-7A Soil Excavation (0-1 ft Basins 1&2)/Disposal On-SRS (CRSB)/Cover	Alternative S-7B Soil Excavation (1×10^{-3} Industrial Risk)/Disposal On-SRS (CRSB)/Cover
Implementability						
Potential Concerns	Low to medium; involves transport further into SRS boundaries	Low to medium: involves transport further into SRS boundaries	Medium to high; involves transport further into SRS boundaries; excavations up to 31 ft below grade.	Medium to high; involves transport further into SRS boundaries; excavations up to 3 I ft below grade.	Medium; involves transport further into SRS boundaries. Delays remedial start date due to additional time necessary to combine OU documents prior to ROD and more rigorous design and modeling efforts.	Medium; involves transport further into SRS boundaries. Delays remedial start date due to additional time necessary to combine OU documents prior to ROD and more rigorous design and modeling efforts.
Relative Implementability	Implementable. Disposal facility designed to accept low-level wastes under established procedures and administrative controls.	Implementable. Disposal facility designed to accept low-level wastes under established procedures and administrative controls.	Implementable. Disposal facility designed to accept low-level wastes under established procedures and administrative controls.	Implementable. Disposal Facility designed to accept low-level wastes under established procedures and administrative controls.	Implementable, but would require establishment of infrastructure, procedures, and administrative systems at CRSB that are already in place for disposal off SRS or at LLWDF, adding to the cost and the schedule.	Implementable. but would require establishment of infrastructure, procedures, administrative and monitoring systems at CRSB that are already in place for disposal off SRS or at LLWDF, adding to the cost and the schedule.
Cost						
	$1,770,000	$3,030,000	$9,800,000	$12,530,000	$2,360,000	$3,690,000

Community Acceptance

Alternative S-l does not provide short and long-term protectiveness of human health and the environment and consequently has not met state and Federal regulatory acceptance. Alternatives S-2 and S-3 do not remove the contaminants from the OU and the long-term effectiveness and permanence is minimal. Therefore, these two alternatives have not met state and Federal regulatory acceptance.

Alternatives S-5A, S-6A and S-7A do not remove all the principal threat source material from the OU and the long-term effectiveness and permanence is not as effective as the other remaining alternatives. Alternative S-7A also has implementability issues that would require extensive infrastructure improvements. Alternative S-6B, S-6C, S-6D, and S-7B have some concerns with different aspects of implementability. Alternatives S-6C and S-6D have some concern with short-term effectiveness and risks to remedial workers since they require excavating the most soils to great depths. Therefore, these seven alternatives have not met state and Federal regulatory acceptance.

The state and Federal regulatory agencies have accepted and approved Alternative S-5B because it removes all the principal threat material, the alternative is implementable, it provides long-term effectiveness and permanence and it is a cost effective solution.

Community acceptance is evident in the acceptance of the preferred alternative by the Savannah River Site Citizens Advisory Board (CAB). On September 29, 1998, the CAB recommended (Recommendation No. 68) that "SRS enact the preferred alternative of shipping the contaminated soils to Utah (Envirocare) and backfilling to the original grade." Further support of the preferred alternative is

evident by the fact that no comments were received from the public during the Statement of Basis/Proposed Plan public comment period.

XI. THE SELECTED REMEDY

Based on the evaluation of the NCP criteria and the RAOs and regulatory recommendations, the preferred alternative is Alternative S-5B, excavate soil above 1 x 10^{-3} industrial risk (principal threat source material), dispose at an off-SRS site, such as Envirocare of Utah, Inc., place an earthen cover over all four basins, and use institutional controls to maintain future industrial land use only. The alternative includes the following benefits:

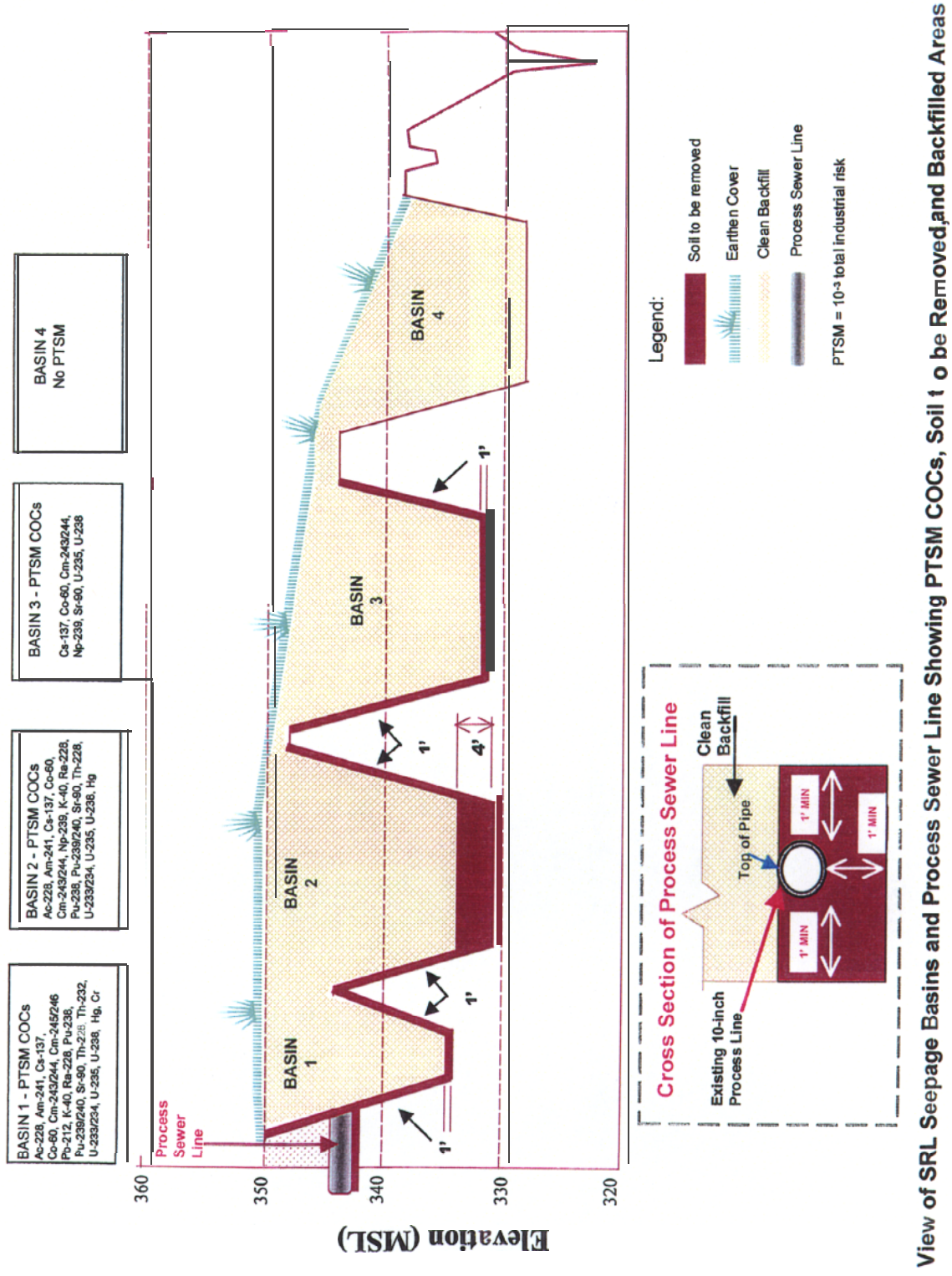
- Reduces the contaminant footprint in this non-nuclear area near the SRS boundary
- Provides a significant reduction of long-term risk at the SRLSB OU
- Eliminates soil contamination threats to future industrial workers at this OU.

This alternative will involve the excavation of all principal threat source material and will remove approximately 1 foot of soil from the bottom and berms of Basin 1, 4 feet from the bottom and 1 foot from the berms of Basin 2, and 1 foot from the bottom and berms of Basin 3. The removal of principal threat source material in Basin 1 will also address the ecological risks associated with chromium (achieving the remedial goal of 200 mg/kg). Principal threat source material is not present in Basin 4; contaminant levels are not above 1 x 10^{-6} industrial risk. Therefore, soil will not be removed from Basin 4. It will also involve removal of the section of process sewer pipeline that runs from the basin to the first manhole, including 1 foot of soil below the pipeline. The contaminated soil and the process sewer pipeline will be removed from the SRLSB OU and disposed of at an approved, licensed out-of-state low level waste disposal facility such as Envirocare of Utah, Inc. A total of 3,207 m^3 of contaminated soil will be removed

from the unit. Residual contamination (at levels below 1 x 10^{-3} industrial risk) will remain in place. The volume of contaminated soil above the 1 x 10^{-6} residential risk level, which will remain and be managed in place at the OU, is approximately 28,000 m^3. However, all four basins will be backfilled with clean soil and an earthen cover will be placed over the four basins, eliminating any risk to the future industrial worker.

Figure 9 presents a cross-sectional view of the SRLSB OU, depicting pre- and post-construction conditions at the unit. Figure 10 summarizes the risk to the future industrial worker of the various soil intervals of each basin.

Before the contaminated soil is removed, erosion control systems will be put in place. The OU will be prepared for construction activities, and temporary health protection facilities will be erected to monitor all soil and equipment leaving the soil contamination area. During the excavation process, confirmation soil sampling will be conducted in the berms and bottoms of the basins and the process sewer pipeline trench. If the sampling reveals soils constituting principal threat wastes (> 1 x 10^{-3} industrial risk) remaining at depths greater than anticipated, those soil areas, or "hot spots", will be excavated and disposed of off SRS. A native soil cover will be placed to minimize infiltration, intrusion, and surface erosion. The cover will extend over all four basins, an area of approximately 100,000 square feet. After remediation has been completed, minimal institutional controls will be implemented. The estimated present worth



View of SRL Seepage Basins and Process Sewer Line Showing PTSM COCs, Soil to be Removed,and Backfilled Areas

Figure 9. Cross-sectional of the SRL Seepage Basins

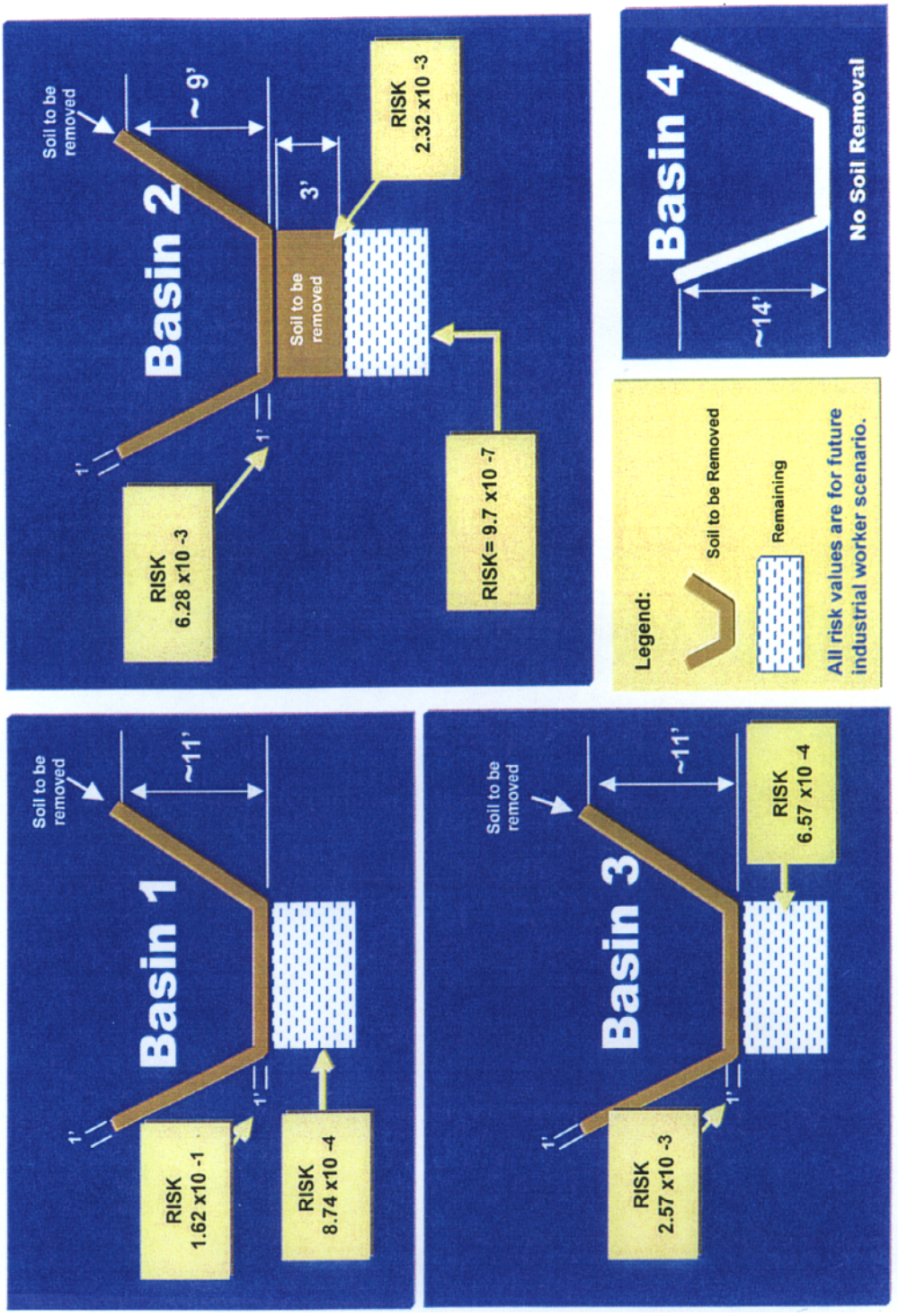


Figure 10.1 Risk to Future Industrial Worker of Soil Being Removed

cost associated with this alternative is $3,550,000. Maintenance costs are minimal. See Table 4 for a detailed activity-based breakdown of estimated costs, and Table 5 for a list of Chemical-, Action-, and Location-Specific ARARs for the Selected Remedy. Based on characterization and risk evaluation, the preferred alternative would meet human health RAOs by eliminating direct contact with radionuclides (surficial soil exposure) and removing all principal threat source material from the unit. The preferred alternative meets the ecological RAO by removing the surface soils (the only soil interval in which chromium is a COC) from Basin 1. For the short term, signs will be posted to indicate that this area was used to manage hazardous materials. In addition, existing SRS access controls will be used to maintain the unit for industrial use.

In the long term, if the property is ever transferred to nonfederal ownership, the U.S. Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of radioactive and chemical wastewater. These requirements are also consistent with the intent of the RCRA deed notification requirements at final closure of a RCRA facility if contamination will remain at the unit.

The deed shall also include deed restrictions precluding residential use of the property. However, the need for these deed restrictions may be re-evaluated at the time of transfer in the event that exposure assumptions differ and/or contamination no longer poses an unacceptable risk under residential use. Any re-evaluation of the need for deed restrictions should be done through an amended ROD with US EPA and SCDHEC approval.

Table 4. Detailed Costs of the Selected Remedy, Alternative S-5B

Item	Unit cost ($)	Units	Quantity	Total Cost ($)
Direct Capital Cost				
Site Work				
Work Plan	$20,000	LS	1	$20,000
Mobilization/Demobilization	15,000	LS	1	15,000
Equipment Decontamination	5,000	LS	1	5,000
Decontamination Pad	7,702	Basin	3	23,106
Excavate and Load	32.86	m^3	3,207	105,382
Confirmation Analysis	155	30 m^3	107	16,570
Rail Transportation	136	m^3	3,207	436,152
Waste Acceptance Criteria Analysis	13.23	m^3	3,207	42,429
Rail Packaging & Disposal	380	m^3	3,207	1,218,660
10^{-5} cm/sec backfill cover	5.75	m^3	45,846	263,615
Vegetative Layer/Topsoil	2.50	m^3	10,000	25,000
				2,170,913
Indirect Capital Costs				
Health & Safety, Insurance, Overhead	60% of Direct Capital Costs			1,302,548
Total Capital Costs:				3,470,000
Institutional Controls				80,000
Total Present Worth Costs				$3,550,000

LS = Lump Sum

Table 5. Chemical-, Action-, and Location-Specific ARARs for the Selected Remedy (Alternative S-5B)

Citation(s)	status	Requirement Summary	Reason for Inclusion
Chemical			
40 CFR 61.92 National Emission Standards for Hazardous Air Pollutants	Applicable	Emissions of radionuclides to the ambient air from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr.	Remedial activities could generate airborne radionuclides.
10 CFR 835 Occupational Radiation Protection	Applicable	Establish radiation protection standards, limits, and program requirements for protecting individuals from ionizing radiation resulting from the conduct of DOE activities.	Establishes dose limits for employees, members of the public during direct on-site access. Establishes monitoring requirements, posting and labeling requirements
Action			
40 CFR 50.6, SC R.61-62.5 Standard 2 Ambient Air Quality Standards	Applicable	The concentration of particulate matter (PM_{10}) in ambient air shall not exceed 50 ug/m^3 (annual arithmetic mean) or 150 ug/m^3 (24-hour average concentration).	Earth-moving activities will generate airborne dust that will have the potential to exceed the levels specified. Dust suppression will likely be required to minimize. dust emissions.
SC R.61-62.6 Fugitive Particulate Matter	Applicable	Emission of fugitive particulate matter shall be controlled in such a manner and to the degree that it does not cause undesirable air pollution	Construction activities shah minimize fugitive emissions. Earth moving activities have the potential to generate airborne particulate matter.
SC R.61-9 NPDES Permits	Applicable	Requires notification of intent to discharge storm water from construction associated with industrial activity that will result in a land disturbance of 5 acres or more and/or industrial activities and sets the requirements for the control of storm water discharges	Potentially applicable if stormwater is discharged during construction activities.
SC R.72-300 Standards for Stormwater Management and Sediment Reduction	Applicable	Stormwater management and sediment control plan for land disturbances	Excavation activities will require an erosion control plan.
49 CFR 107, 171-179 DOT Hazardous Materials Transportation Regulations	Applicable	Specific requirements for handling, packaging, labeling, and transporting wastes containing DOT hazardous substances.	Excavated soil will be containerized and sent to disposal facility out of state.

Table 5. Chemical-, Action-, and Location-Specific ARARs for the Selected Remedy (Alternative S-5B) (Cont'd.)

Citation(s)	Status	Requirement Summary	Reason for Inclusion
Location			
16 USC 661	Applicable	The remedial action must be conducted in a manner to protect fish or wildlife.	This remedial action has the potential to affect wildlife in the vicinity of the SRL basins. The action will not affect fish located at the SRS or in nearby bodies of water.
Executive Order I 1990	Applicable	The remedial action must minimize the destruction, loss, or degradation of wetlands.	Wetlands are located in the vicinity of the SRL basins; however, they will be unaffected by this action.

In addition, if the site is ever transferred to non-federal ownership, a survey plat of the operable unit will be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

Per the US EPA-Region IV Land Use Controls Policy (LUCs), a LUCAP for SRS has been developed and submitted to the regulators for their approval. In addition, a LUC Implementation Plan for the SRLSB OU has been developed and submitted to the regulators for their approval with the post-ROD documentation. The LUCIP details how SRS will implement, maintain, and monitor the land use control elements of the SRLSB OU preferred alternative to ensure that the remedies remain protective of human health and the environment.

This preferred alternative is intended to be the final action for the SRLSB OU. The solution is intended to be permanent and effective in both the long and short terms.

The remedy may change as a result of the remedial design or construction. Therefore, changes in the ROD will be documented in the Administrative Record, through an Explanation of Significant Difference or ROD Amendment.

XII. STATUTORY DETERMINATIONS

Based on the SRLSB OU RFI/RI Report and the BRA, the SRLSB OU poses significant risk to human health. Therefore, a determination has been made that Alternative S-5B, excavation of the contaminated soil, disposal off SRS, and placement of an earthen cover with institutional controls is protective of human health and the environment for the residual contamination at the SRLSB OU.

The selected remedy is protective of human health and the environment, complies with federal and state requirements legally applicable or relevant and appropriate

to the remedial action, and is cost effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. However, because treatment of the principal threat source material was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element.

Section 300.430 (f)(4)(ii) of the NCP requires that a S-year remedy review of the ROD be performed if hazardous substances, pollutants, or contaminants remain in the waste unit. The three Parties, US DOE, SCDHEC, and US EPA, have determined that a 5-year review of the ROD for the SRLSB OU will be performed to ensure continued protection of human health and the environment.

XIII. EXPLANATION OF SIGNIFICANT CHANGES

The SB/PP and the draft RCRA permit modification provided for involvement with the community through a document review process and a public comment period. Comments received during the 45-day public comment period (January 29,1999 through March 14,1999) are addressed in Appendix B of this ROD and are available with the final RCRA permit. There were no significant changes to the selected remedy as a result of public comments.

XIV. RESPONSIVENESS SUMMARY

No comments were received during the public comment period. The Responsiveness Summary is Appendix B of this ROD.

XV. POST-ROD DOCUMENT SCHEDULE

The post-ROD document and implementation schedule is listed below and is illustrated in Figure 11. Remedial action construction at the SRLSB OU is planned for an early start in December 1999 with completion in June 2001.

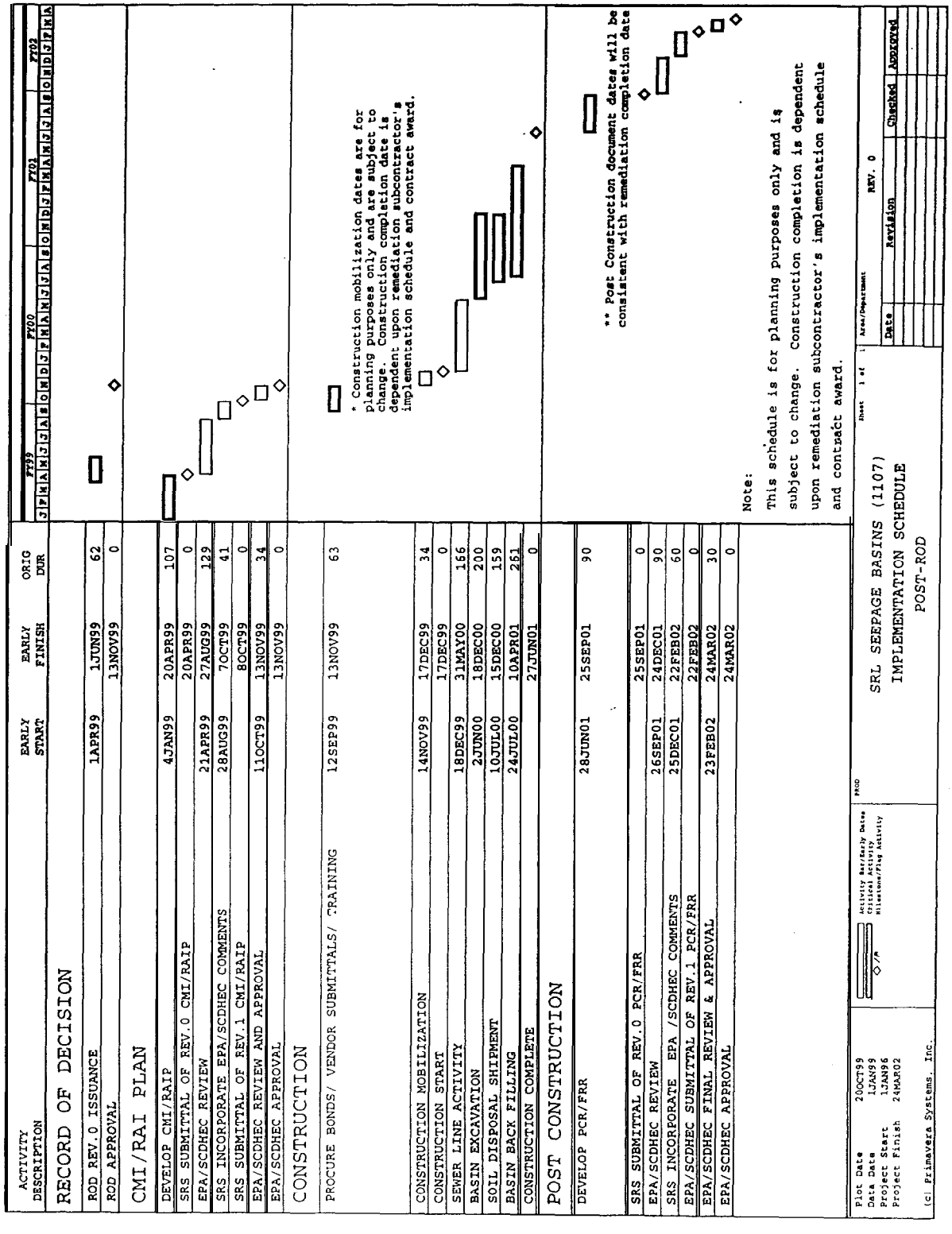


Figure 11. Post-ROD Document Schedule

This cleanup schedule represents a 14 month acceleration of action over the schedule agreed upon in the SRS FAA (a February 2001 remediation start) for this unit.

The Corrective Measures Implementation/Remedial Action Implementation Plan has been submitted to the regulators for their review and approval.

This document includes the following:

- General description of unit,
- Remedial action schedule,
- Discussion of design activities, design criteria and permitting requirements,
- Design drawings and a discussion of the permit and construction specifications,
- Remedial design change control and US EPA/SCDHEC review of remedial design changes,
- Waste management,
- A discussion of Quality Assurance, Health and Safety Plan and Emergency Plan Implementation Strategy,
- Requirements for project closeout, and
- Land Use Control Implementation Plan.

XVI. REFERENCES

US DOE, 1994. *Public Involvement, A Plan for Savannah River Site.* Savannah River Operations Office, Aiken, South Carolina (1994).

US DOE, 1996. *Savannah River Site Future Use Project Report, Stakeholder Recommendations for SRS Land and Facilities (U).* Savannah River Operations Office, Aiken, South Carolina (January 1996).

FFA, 1993. *Federal Facility Agreement for the Savannah River Site.* Appendix C. Docket No. 89-05-FF, WSRC-RP-94-42, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC.

WSRC, 1993a. *Closure Plan for the SRL Seepage Basins.* WSRC-RP-425-3, Revision 1. Westinghouse Savannah River Company, Savannah River Site, Aiken, SC (December 18, 1993).

WSRC, 1996. *RCRA Facility Investigation/Remedial Investigation Work Plan for the SRL Seepage Basins.* WSRC-RP-96-1556, Rev. 1, Westinghouse Savannah River Company, Aiken, South Carolina (July 1996).

WSRC, 1998a. *RCRA Facility Investigation/Remedial Investigation Report including Baseline Risk Assessment and Focused Corrective Measures Study/Feasibility Study for the SRL Seepage Basins OU (904-53G, -54G, and -55G) (U).* WSRC-RP-97-846, Rev. 1.1, Westinghouse Savannah River Company, Aiken, South Carolina (September 1998).

WSRC, 1998b. *Statement of Basis/Proposed Plan for the SRL Seepage Basins OU (904-53G1, -53G2, -54G, and -55G)(U).* WSRC-RP-97-847, Rev. 1, Westinghouse Savannah River Company, Aiken, South Carolina (September 1998).

APPENDIX A

POTENTIAL ARARs FOR ALL ALTERNATIVES

Appendix A. Potential ARARs for All Alternatives

Citation(s)	Status	Requirement Summary	Reason for Inclusion	Alternative
Chemical				
40 CFR 61.92 National Emission Standards for Hazardous Air Pollutants	Applicable	Emissions of radionuclides to the ambient air from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of IO mrem/yr.	Remedial Activities could generate airborne radionuclides	S-5A, S-5B
10 CFR 835 Occupational Radiation Protection	Applicable	Establish radiation protection standards, limits, and program requirements for protecting individuals from ionizing radiation resulting from the conduct of DOE activities 10 CFR 835.1001 mandates ALARA principles	Establishes dose limits for employees, members of the public during direct on-site access. Establishes monitoring requirements, posting and labeling requirements	S-2, S-3, S-5A, S-5B
Action				
40 CFR 50.6, SC R.61-62.5 Standard 2 Ambient Air Quality Standard	Applicable	The concentration of particulate matter (PM,,) in ambient air shall not exceed 50 ug/m^3 (annual arithmetic mean) or 150 ug/m^3 (24-hour average concentration	Earth-moving activities will generate airborne dust that will have the potential to exceed the levels specified. Dust suppression will likely be required to minimize dust emissions.	S-5A, S-5B
SC R.61-62.6 Fugitive Dust	Applicable	Emission of fugitive particulate matter shall be controlled in such a manner and to the degree that it does not cause undesirable air pollution	Construction activities shall minimize fugitive emissions. Earth moving activities have the potential to generate airborne particulate matter.	S-5A, S-5B
SC R.61-9 NPDES Permits	Applicable	Requires notification of intent to discharge storm water from construction associated with industrial activity that will result in a land disturbance of 5 acres or more and /or industrial activities and sets the requirements for the control of storm water discharges	Potentially applicable if storm water is discharged during construction activities.	S-5A, S-5B
SC R.72-300 Standards for Stormwater Management and Sediment Reduction.	Applicable	Storm water management and sediment control plan for land disturbances	Construction activities will require an erosion control plan.	S-5A, S-5B, S-2, S-3, S-6A, S-6B, S-6C, S-6D, S-7A, S-7B
40 CFR 107, 171-179 DOT Hazardous Materials Transportation Regulations	'Applicable	Specifies requirements for handling, packaging, labeling, and transporting wastes containing DOT hazardous substance.	If basin soils are excavated for off site disposal they will be containerized, labeled and transported.	S-5A, S-5B

Appendix A. Potential ARARs for All Alternatives (Cont'd.)

Citation(s)	Status	Requirement Summary	Reason for Inclusion	Alternative
Action				
10 CFR 61.42 Licensing Requirements for Land Disposal of Radioactive Waste	Relevant and Appropriate	Design, operation and closure of the land disposal facility must protect against inadvertent intrusion and occupying of site after active institutional controls are removed	If basins soils are to be left in place may be considered a radioactive land disposal facility	S-2, S-3, S-6A, S-6B, S-6C, S-6D, S-IA, S-7B
IO CFR 61.53 Licensing Requirements for Land Disposal of Radioactive Waste	Relevant and Appropriate	After the disposal site is closed post-operational surveillance of the disposal site shall maintain a monitoring system based on the operating history and the closure and stabilization of the disposal site. The monitoring system must be capable of providing early warning of releases of radionuclides from the disposal site before they leave the site boundary.	If the basin soils are to be left in place, it may be considered a radioactive waste disposal facility and ground water monitoring may be required.	S-2, S-3, S-6A, S-6B, S-6C, S-6D, S-7A, S-7B
40 CFR 264.310, SCR.61-79.310 Federal and State Hazardous Waste Regulations	Relevant and Appropriate	Closure and post-closure care requirements. Cover system of $1x10^{-7}$ cm/sec hydraulic conductivity. Cap maintanence requirements	RCRA cap standards and maintenance requirements	S-2
Location				
IO CFR 61.50 Licensing Requirements for Land Disposal of Radioactive Waste	Relevant and Appropriate	Radioactive land disposal facilities shall not be located in a 100 yr. flood plain or in unstable areas.	If basin soils are to be left in place, may be considered a radioactive land disposal facility	S-2, S-3, S-6A, S-6B, S-6C, S-6D, S-IA, S-7B
16 USC 661	Applicable	The remedial action must be conducted in a manner to protect fish or wildlife.	This remedial action has the potential to affect wildlife in the vicinity of the SRL basins. The action will not affect fish located at the SRS or in nearby bodies of water.	S-5A, S-5B
Executive Order 11990	Applicable	The remedial action must minimize. the destruction, loss, or degradation of wetlands.	Wetlands are located in the vicinity of the SRL basins; however, they will be unaffected by this action.	S-5A, S-5B
*OSHA 1910.12(	29 CFR 1910)	to be considered in the completion of	I remedial alternatives.	

APPENDIX B

RESPONSIVENESS SUMMARY

Responsiveness Summary

The 45-day public comment period for the Statement of Basis/Proposed Plan for the SRLSB OU began on January 29,1999 and ended March 14,1999. There were no public comments.